In Parliament – Session 2021 - 2022

HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 4: Off-route effects

M33

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Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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The Environmental Statement

This document is Volume 4 of the Environmental Statement (ES) that accompanies the deposit of the High Speed Rail (Crewe – Manchester) hybrid Bill (hereafter referred to as the Bill). This Bill would authorise:

- the Phase 2b Western Leg, which comprises the section of the proposed High Speed Two (HS2) rail network from Crewe to Manchester, with connections onto the West Coast Main Line;
- a number of works that are required beyond the route, such as to the existing conventional rail network, to enable the operation of the Western Leg; and
- provision for future Northern Powerhouse Rail services to connect with HS2.

Collectively, these are referred to in this ES as 'the Proposed Scheme'. The ES describes the Proposed Scheme and reports its likely significant environmental effects and the measures proposed to mitigate adverse effects.

The hybrid Bill for Phase One of the HS2 network, between London and the West Midlands, was the subject of an ES deposited in November 2013. The Phase One hybrid Bill received Royal Assent in February 2017. The Main works on Phase One commenced in April 2020.

The hybrid Bill for Phase 2a of the HS2 network, between the West Midlands and Crewe, was the subject of an ES deposited in July 2017. The Phase 2a Bill received Royal Assent in February 2021.

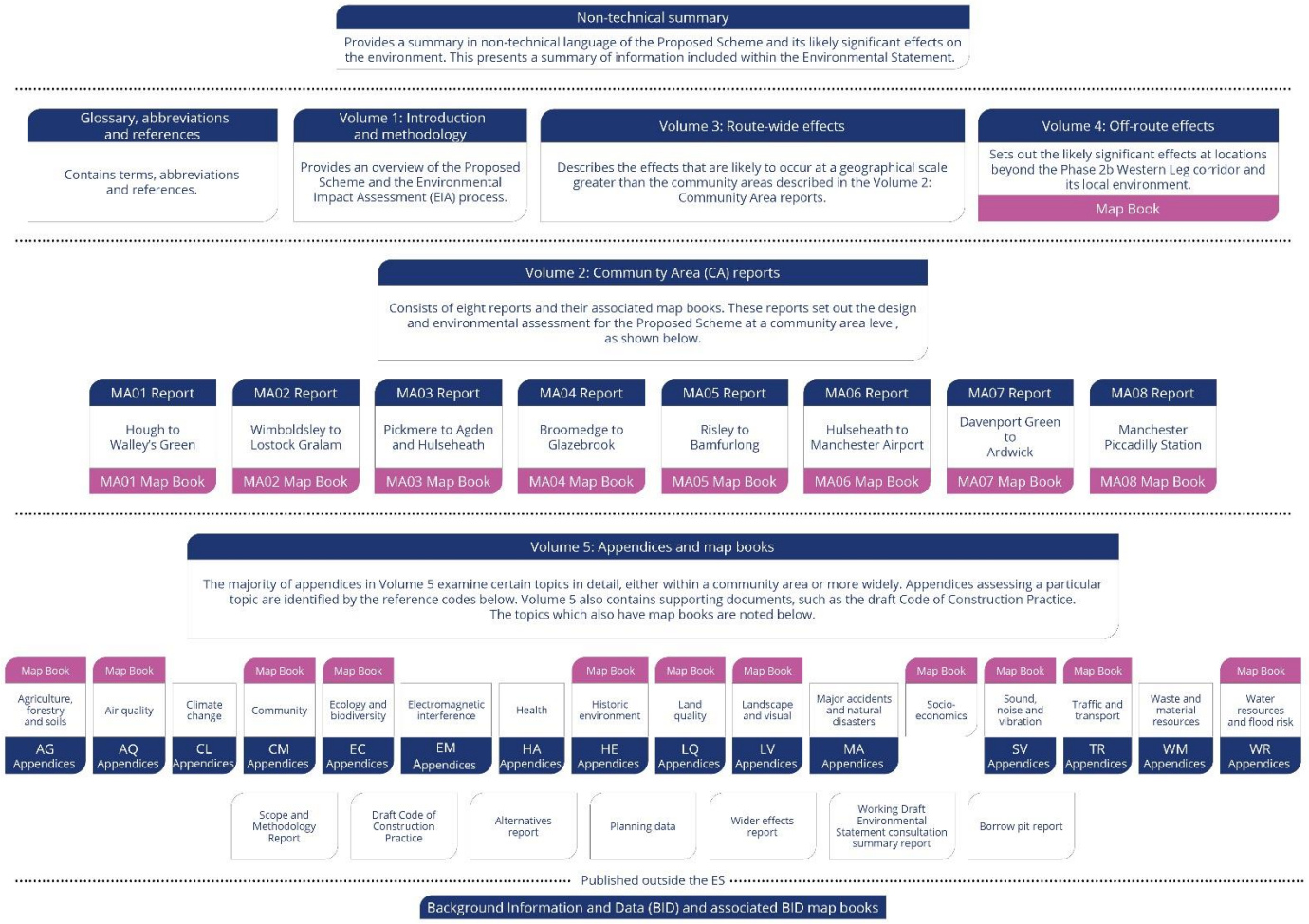
Consultation on the Environmental Statement

The public has an opportunity to comment on this ES which accompanies the deposit of the Bill. The period of public consultation on the ES extends for at least 56 days (eight weeks) after the first newspaper notices that follow deposit of Bill documents in Parliament.

Structure of the Environmental Statement

This report is part of the suite of documents that make up the ES for the Proposed Scheme. The structure of the ES is shown in Figure 1 and described in more detail in Volume 1. The ES has been prepared by persons who have sufficient expertise to ensure the completeness and technical quality of the statement.

Figure 1: Structure of the Environmental Statement



1 Introduction

1.1 Overview of High Speed Two

1.1.1 High Speed Two (HS2) is a new high speed railway proposed by the Government to connect major cities in Britain. It will transform intercity and long distance passenger rail travel in the UK, providing the first major increase in intercity rail capacity for over a century and freeing up substantial capacity for rail travel and freight on the conventional rail network. London, Birmingham, Manchester and cities in the Midlands, the North and Scotland will be served by high speed trains running at speeds of up to 360kph (225mph) on HS2 lines and on the existing conventional rail network. As part of the Proposed Scheme, new stations will be built at Manchester Piccadilly and Manchester Airport, in addition to the new stations in London and the West Midlands included in HS2 Phase One.

1.1.2 The Proposed Scheme comprises:

- the HS2 Western Leg from Crewe to Manchester, including:
  - new stations at Manchester Airport and Manchester Piccadilly;
  - a depot north of Crewe;
  - maintenance facilities north of Crewe and at Ashley; and
  - a connection onto the West Coast Main Line (WCML) near Bamfurlong;
- the Crewe Northern Connection, connecting the route of the Proposed Scheme with the WCML and enabling future Northern Powerhouse Rail (NPR) services to connect with HS2;
- provision for the NPR London to Liverpool, Manchester to Liverpool, and Manchester to Leeds junctions, to enable these future NPR routes to connect with HS2; and
- a number of works at locations beyond the Western Leg route corridor, referred to as 'off-route works', which include:
  - works to enable HS2 trains to call at existing stations further north on the WCML; and
  - construction of depots to provide overnight stabling for HS2 trains serving the north of England and Scotland.

1.2 Structure of this report

1.2.1 Volume 4 describes the off-route works that have potential to give rise to likely significant environmental effects. It presents findings for those environmental topics that are scoped in and reports the environmental baseline, an assessment of construction and operational effects, the proposed mitigation measures, the likely significant residual effects and any requirements for monitoring for each of those topics.

1.2.2 This report is Volume 4 of the Environmental Statement (ES) and accompanies the deposit of the hybrid Bill. It describes the likely significant environmental effects associated with works

required for the Proposed Scheme that are remote to the Phase 2b Western Leg route corridor. Such works are referred to as 'off-route works' and include works to allow HS2 trains to call at existing stations further north on the WCML and works to provide stabling and supporting facilities to serve HS2 trains at or near the start/end of journeys (these works are located in both England and Scotland). This report comprises the following sections:

- Section 1 provides an overview of HS2 and the ES;
- Section 2 explains the types of off-route works proposed and the approach to their assessment. It also provides information on construction and operation of the Proposed Scheme that is common to all the off-route works;
- Sections 3-4 describe the off-route railway stations where physical works, such as the extension of platforms, are required to allow HS2 trains to call at these stations and report the associated likely significant environmental effects;
- Section 5 describes the off-route railway stations that may be affected by the operation of the Proposed Scheme and reports the associated likely significant environmental effects; and
- Section 6 describes off-route depot/stabling facility provision and reports the associated likely significant environmental effects.

2 Approach and scope of assessment

2.1 Introduction

2.1.1 This section presents the approach to the assessment of off-route effects. It outlines the methodology for the assessment, the types of off-route works included for assessment, and the general approach to construction and operation of the off-route works.

2.2 Methodology

2.2.1 The EIA Scope and Methodology Report (SMR)[1] sets out the geographic and temporal scope for the EIA. The SMR (Sections 4.1 and 4.2) refers to the need for the EIA to consider any likely significant effects experienced outside of the community areas reported in Volume 2, Community Area reports, and caused by activities such as HS2 services on the existing conventional railway network and changes to HS2 passenger levels on Phase One and Phase 2a as a result of the Proposed Scheme and consequential effects.

2.2.2 The draft SMR (the 2017 SMR) was formally consulted on between July and September 2017 and was issued to statutory bodies, non-government organisations and local authorities. It was made available on the gov.uk website, allowing comment by local interest groups and the public. A total of 107 responses to 2017 SMR were received, as a result of which changes were made. A revised SMR was published in October 2018 (the 2018 SMR) as part of the working draft ES. The changes between the 2017 SMR and the publication of the 2018 SMR were set out in the SMR Consultation Report[2], also published in October 2018.

2.2.3 Following formal consultation on the working draft ES (which included the 2018 SMR), further engagement has been undertaken with relevant local authorities and statutory stakeholders in Scotland as the design and assessment develops. The SMR published as part of this ES takes into consideration feedback from Scottish stakeholders, incorporation of Scottish guidance and EIA methodology relating to Scotland.

2.2.4 The ES reports on the basis of the requirements in the Town and Country Planning (EIA) Regulations 2017 (England) and the Town and Country Planning (EIA) (Scotland) Regulations 2017. There is no substantive difference between the English and Scottish regulations. Where any of the HS2 works fall within Scotland, relevant legislation, policy and guidance has been applied and any relevant data provided by the Scottish Government, relevant local authorities and statutory bodies have been applied to the assessment of those works. The

[1] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

[2] High Speed Two Ltd (2018), *HS2 Phase 2b: Crewe to Manchester and West Midlands to Leeds Environmental Impact Assessment Report Scope and Methodology Report*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/745518/HS2_Phase_2b_Working_Draft_ES_EIA_Scope_and_Methodology_Report.pdf.

ES uses relevant terminology, and also refers to the relevant regulatory bodies and environmental consultees for Scotland.

2.2.5 The methodologies used for the assessments of off-route impacts described in Sections 3 to 6 of this report accord, unless stated otherwise, with the methodologies for each environmental topic described in the SMR and Volume 1, Introduction and methodology. The environmental baseline, an assessment of construction and operational effects, the proposed mitigation measures, the likely significant residual effects and any requirements for monitoring are reported in this volume of the ES.

2.2.6 All environmental topics have been evaluated as part of a scoping exercise undertaken in accordance with the SMR. This determined the extent to which they should be included in each of the assessments of off-route effects reported in this Volume of the ES, having regard to whether there are likely to be significant effects that relate to them. Where no potential for likely significant effects was identified, an environmental topic, or aspects of the topic (e.g. operation), has been scoped out of the assessment.

2.2.7 In addition to the environmental topics covered in Sections 3 to 6 of this report, climate change, major accidents and disasters, waste and material resources and electromagnetic interference are addressed in Volume 3, Route-wide effects, on a route-wide basis.

2.3 Stakeholder engagement

2.3.1 HS2 Ltd's approach to stakeholder engagement and consultation on the Proposed Scheme is set out in Volume 1, Introduction and methodology, Section 3.

2.3.2 Since the initial Phase 2b preferred route announcement in November 2016, HS2 Ltd has carried out a programme of stakeholder engagement and consultation with a broad range of stakeholders. A variety of mechanisms has been used to enable an open and inclusive approach to engagement and consultation, reflecting the differing requirements and expectations of stakeholders.

2.3.3 Relevant feedback from stakeholder engagement and the consultations on the working draft ES has been considered as part of the design and assessment of the Proposed Scheme presented in this ES.

2.3.4 Further information on stakeholder engagement undertaken for off-route works is provided in Sections 3 (Preston Station), 4 (Carlisle Station) and 6 (Annandale depot).

2.4 Off-route works and changes in passenger numbers

2.4.1 The following are included within the assessments reported in this Volume of the ES and outlined in this section:

- railway stations – construction of improvements, alterations and adaptations at existing off-route stations that will be served by HS2 trains;
- railway stations – changes in passenger numbers at certain existing railway stations across the rail network as a consequence of the introduction of HS2 services;
- railway stations – changes in passenger numbers at HS2 Phase One stations as a consequence of the introduction of Proposed Scheme services; and
- a new depot/stabling facility – construction of a new depot/stabling facility to reduce the need for empty train movements of out of service HS2 trains.

Off-route railway stations – improvements, alterations and adaptations at existing off-route stations

2.4.2 Once the Proposed Scheme is completed there will be new, or increased frequency of HS2 services to destinations including Liverpool, Glasgow and Edinburgh.

2.4.3 Sections 3 and 4 of this report identify the existing off-route railway stations (at Preston and Carlisle) on the conventional railway network where the need for physical construction works to accommodate HS2 trains has been identified and these works have the potential to give rise to significant environmental effects. These stations are on the WCML. Works will be required to accommodate 400m long HS2 trains[3] that will be introduced by the Proposed Scheme on the WCML and to address station capacity constraints arising from use by HS2 services.

Off-route railway stations – forecast changes in passenger numbers at existing stations

2.4.4 The operation of the Proposed Scheme, and the consequent release of capacity elsewhere, will result in changes to passenger numbers at some off-route railway stations across the conventional railway network. This includes HS2 Phase One stations. Section 5 describes the process for identifying these off-route stations and reports the likely significant environmental effects of the changes.

Off-route depots

2.4.5 HS2 trains serving the north of England and Scotland will need access to off-route depots. This is because it is operationally impracticable for them to be returned from the terminating stations on the conventional network to the proposed HS2 depots on the new

[3] 400m trains will consist of two 200m trains joined together. Some platforms at existing stations on the conventional rail network, at which HS2 trains will call, are not currently long enough to accommodate 400m trains.

HS2 route at the end of the day and then returned in the morning. The use of off-route depots will reduce the movement of empty HS2 trains.

2.4.6 The off-route depots/stabling facilities will be used for overnight stabling and servicing, such as cleaning and maintenance of HS2 trains.

2.4.7 Maintenance activities will vary from one location to another but may include:

- inspection of units;
- cleaning;
- re-stocking consumables; and
- watering and emptying controlled emission toilets.

2.4.8 Most of these activities will take place outside of the usual operating hours of the HS2 train service and will include work during the night and at weekends. The stabling, cleaning and maintenance activities that are undertaken at train depots/stabling facilities will require trains to be moved around the facility during these periods to allow the efficient use of fixed equipment and facilities.

2.4.9 The assessment of likely significant effects resulting from the provision of off-route depots/stabling facilities is reported in Section 6.

2.4.10 As part of HS2 Phase One, a number of depots/stabling facilities (Edge Hill depot, Liverpool; Longsight depot, Manchester; Longsight International depot, Manchester; and Polmadie depot, Glasgow) were expected to require works to accommodate HS2 conventional compatible trains. The impacts of these works were reported in Volume 4 of the HS2 Phase One ES. These depots/stabling facilities will also serve trains using the Proposed Scheme, but no additional works are expected to be required that are likely to give rise to new or different likely significant environmental effects to those reported in the Phase One ES.

2.4.11 The operation of the Proposed Scheme requires two off-route depots/stabling facilities, which will be provided in the following locations:

- Annandale (between Gretna Green and Kirkpatrick Fleming); and
- Polmadie, Glasgow. This depot was identified and assessed in the Phase One ES[4], at which point it was assumed that four HS2 trains would be stabled here. Phase 2b requires stabling for up to an additional seven trains at Polmadie. HS2 trains will replace trains currently stabled at Polmadie. Some minor works associated with the carriage washing machine plant, signal sighting/testing, water provision and door steps are expected to be needed, but are not considered to have potential to give rise to new or different likely significant environmental effects from those assessed in the Phase One ES and therefore no further assessment has been carried out.

[4] High Speed Two Ltd (2013), High Speed Rail (London – West Midlands), *Environmental Statement, Volume 4: Off-route effects.* Available online at: https://www.gov.uk/government/publications/hs2-phase-one-environmental-statement-volume-4-off-route-effects.

2.5 Issues scoped out of the off-route assessment

Future modifications to the conventional railway network

2.5.1 At the time of undertaking the EIA no requirement for works to the conventional railway network has been identified, other than minor modifications, such as track, signalling and overhead line works, associated with proposed off-route works at Preston Station, Carlisle Station and Annandale depot, as described in this report. If a need for such works is identified in the future, and insofar as those works require further powers, or potentially give rise to likely significant effects, further applications for consents or approvals will be made at the relevant time.

Assessment of forecast changes in movements on the conventional railway network

2.5.2 The Proposed Scheme will contribute to an increase in capacity on the UK's long-distance railway network. By providing direct services on dedicated high speed lines, HS2 will release capacity on the congested WCML, south of Golborne. North of this location HS2 trains will operate on the conventional railway network providing services to destinations including Preston, Glasgow and Edinburgh.

2.5.3 Off-route works may result in some alterations to the timing and numbers of existing conventional rail and freight train services in order to accommodate HS2 services.

2.5.4 The operation of HS2 will therefore result in changes to train service specifications on the conventional railway network at off-route locations. These changes have been considered, together with the increased speed of services on parts of the WCML with the environmental assessment reported in Volume 3, Route-wide effects.

2.6 Changes to the design since the working draft ES

2.6.1 The working draft ES outlined the off-route works expected to be required at that time across both the Western Leg and Eastern Leg of the Phase 2b scheme. This ES has, however, been prepared for the Western Leg only of the Phase 2b scheme, and therefore any off-route works associated with the Eastern Leg have not been assessed and are not reported in this Volume of the ES.

2.6.2 Design and optioneering work at the time the working draft ES was prepared was at an early stage and only limited information was available. Since then further design and optioneering studies have been undertaken to determine the extent of physical works required for the Proposed Scheme. The main outcomes of these studies include confirmation that:

- physical works will be required at Preston Station and Carlisle Station to accommodate HS2 trains calling at these stations;
- HS2 trains will not stop for passengers at Carstairs Station, and Carstairs Station has been removed from the scope of off-route works;
- HS2 trains will split and join (the process by which 2 x 200m trains combine to form a 400m train and vice versa) at Carlisle Station instead of Carstairs Station;
- a site in Annandale (between Gretna Green and Kirkpatrick Fleming) has been identified for a new depot between Carlisle, Glasgow and Edinburgh, to be accessed from the WCML[5]; and
- there are no other proposed off-route modifications to the conventional railway network as part of the Proposed Scheme (other than minor modifications described at paragraph 2.5.1).

2.7 Alternatives

2.7.1 Volume 5 Appendix CT-003-00000 sets out the alternative options considered when identifying the scope and location of off-route works, and the reasons why preferred options were chosen.

2.7.2 The identification of a depot/stabling facility in north of England/Scotland involved consideration of a number of alternative options before confirmation of Annandale depot as the preferred site. The decision to split and join at Carlisle Station was made following consideration of alternative options, including the option of splitting and joining at Carstairs.

2.7.3 No alternative options were considered for proposed works at Preston Station and Carlisle Station. The nature of the works, and the specific requirement for platform extensions and associated improvements at these stations to accommodate HS2 trains (in accordance with the Phase 2b business case), meant that there were no viable alternative options for consideration.

2.8 Construction and operation of the off-route works

2.8.1 This section provides general information on the approach to construction and operation that will be employed for off-route works and should be referred to when reading assessments for individual works and locations.

[5] In early discussions with local stakeholders this site was referred to as 'Gretna stabling facility', but has since been renamed as 'Annandale depot'.

Construction of the off-route works

2.8.2 This section, and further information included within Sections 3, 4 and 6 for individual off-route works, describes the key construction activities that are envisaged to be needed to build the off-route works. It includes:

- an overview of the construction process;
- a description of the advance works;
- a description of the engineering works to build the Proposed Scheme;
- information on construction waste and material resources;
- a description of how the Proposed Scheme will be commissioned;
- an indicative construction programme; and
- monitoring arrangements during the construction period.

2.8.3 The construction arrangements described in this report provide the basis for the assessment of off-route works presented in this Volume. Land used only for construction purposes will be restored as agreed with the owner of the land and the relevant planning authority once construction works on that land are complete. Land required permanently for the key features of the Proposed Scheme is described in the relevant sections of this report.

2.8.4 During the construction phase, public roads and public right of way (PRoW) routes will remain open for public use where reasonably practicable. Where such routes cross the Proposed Scheme and require diversion, the alternative road or PRoW crossing the Proposed Scheme will be constructed prior to any closure of existing roads or PRoW wherever reasonably practicable. Where they cross the Proposed Scheme in proximity to their existing alignment, a temporary alternative alignment may be required. In some instances, diverted or realigned roads or PRoW may need to pass through areas required for construction of the Proposed Scheme. Routes through these areas will be identified by the nominated undertaker and provided where it is safe and reasonably practicable to do so. The routes through these areas may change over the duration of the construction period.

2.8.5 Volume 1, Introduction and methodology, Section 5 and Section 6 provide details of the permanent features of the Proposed Scheme and typical construction techniques. For the purposes of the environmental assessment, standard construction techniques as described in Section 6 of Volume 1, Introduction and methodology, have been assumed.

Code of Construction Practice

2.8.6 All contractors will be required to comply with a Code of Construction Practice (CoCP). In addition, Local Environmental Management Plans (LEMP) will be produced for each local authority area. The CoCP and LEMP will be the means of controlling the construction works associated with the Proposed Scheme, and will set out monitoring requirements, with the objective of ensuring that the effects of the works on people and the natural environment are reduced insofar as reasonably practicable. The CoCP will contain generic control measures and standards to be implemented throughout the construction process. The LEMP

will set out how the project will adapt and deliver the required environmental and community protection measures within each area through the implementation of specific measures required to control dust and other emissions from activities in the area.

2.8.7 In addition, HS2 Ltd has produced a Community Engagement Framework, which sets out how HS2 Ltd and its contractors, as well as their sub-contractors, will undertake community engagement during the construction of the HS2 project. The framework is being implemented on Phase One of HS2 and is applicable to all phases of HS2.

2.8.8 The objectives of the framework include:

- to set out how HS2 Ltd and its contractors will undertake community engagement during the construction of the project;
- to provide clarity and reassurance to HS2 Ltd's stakeholders about how community engagement activity will be managed; and
- to help HS2 Ltd be a good neighbour to local communities, including by providing accurate and timely information about construction works and offering opportunities to influence them, where appropriate.

2.8.9 A draft CoCP has been prepared[6]. It will remain a draft document through the Parliamentary process and the CoCP will be finalised at Royal Assent. The CoCP sets out measures to be implemented by the nominated undertaker.

Overview of the construction process

2.8.10 Building and preparing the Proposed Scheme, including off-route works, for operation will comprise the following general stages:

- advance works including: site investigations further to those already undertaken; preliminary mitigation works; preliminary enabling works;
- civil engineering works including: establishment of construction compounds; site haul routes, site preparation and enabling works; main earthworks and structure works; site restoration; removal of construction compounds where the compound is not required for railway installation works; and associated utility diversions;
- railway installation works including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the existing rail network; site restoration; and removal of construction compounds;
- site finalisation works; and
- systems testing and commissioning.

2.8.11 General information about the construction process is set out in more detail in Volume 1, Introduction and methodology, Section 6, and the draft CoCP, including:

[6] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP).*

- the approach to environmental management during construction and the role of the CoCP (Section 2);
- working hours (Section 5);
- management of construction traffic (Section 14); and
- handling of construction materials (Section 15).

Advance works

2.8.12 General information about advance works can be found in Volume 1, Introduction and methodology, Section 6. Advance works will be required before the main construction works commence and typically include:

- further detailed site investigations and surveys for proposed construction compounds;
- further detailed environmental surveys;
- advance mitigation works including, where appropriate, contamination remediation, habitat creation and translocation, landscape planting and built heritage survey and investigation;
- advance site access works;
- site establishment with temporary fence construction;
- removal of vegetation, and stripping and storing of soil; and
- utility diversions and new utility connections for facilities associated with the Proposed Scheme.

Engineering works

Introduction

2.8.13 Construction of the off-route works will require the following broad types of engineering works:

- civil engineering works, including provision of construction compounds, extensions to station platforms, works to subways and footbridges, internal roads and car park, and construction of maintenance shed and accommodation block; and
- works to install, test and commission railway systems, including track, overhead line equipment, communications and signalling equipment and traction power supply.

2.8.14 Each set of off-route works will generally be managed from one main construction compound, with satellite compounds as required. The compound will act as the main interface between the construction work site and the public highway, as well as performing other functions as described in each of the relevant sections of this report. The compounds will be used for civil engineering works and/or railway installation works.

General overview of the construction compound

2.8.15 The construction compounds will be used by project staff and will include:

- space for the storage of bulk materials;
- space for the receipt, storage and loading and unloading of excavated material;
- an area for the fabrication of temporary works equipment and finished goods;
- fuel storage;
- plant and equipment storage including plant maintenance facilities; and
- office space for management staff, limited car parking for staff and site operatives, and welfare facilities.

2.8.16 Further details on construction compounds for each set of off-route works are provided in Sections 3, 4 and 6.

Construction traffic routes

2.8.17 Construction vehicles, when loaded, will carry materials, plant, other equipment and the workforce. Vehicle movements will take place on public roads, within construction compounds and between the compounds and working areas.

2.8.18 The construction compounds will provide the interface between the construction works and the public road or railway network. The likely road routes to access each of the off-route works compounds are described in the relevant sections of this report.

Construction waste and material resources

2.8.19 Forecasts of the amount of construction, demolition and excavation waste (CDEW) that will be produced during construction of the Proposed Scheme are reported in Volume 3, Route-wide effects.

2.8.20 Local excess or shortfall of excavated material within areas where off-route works are constructed will be managed through the mitigation earthworks design approach adopted for the Proposed Scheme, with the aim of contributing to an overall balance of excavated material on a route-wide basis. The overall balance of excavated material is presented in Volume 3, Route-wide effects, Section 15.

Commissioning of the railway

2.8.21 Commissioning is the process of testing the infrastructure to ensure that it operates as expected. It will be carried out in the period prior to opening. Further details are provided in Volume 1, Introduction and methodology, Section 6.

Construction programme

2.8.22 A construction programme illustrating indicative periods for each of the core construction activities described above is provided in each relevant section of this report.

Monitoring during construction

2.8.23 The appointed contractor will be required to undertake the necessary monitoring for each environmental topic to comply with the requirements of the CoCP, the relevant LEMP and any additional consent requirements. Any actions that may be necessary for compliance will be reported to the nominated undertaker and remedial action identified.

2.8.24 The CoCP and the relevant LEMP will set out inspection and monitoring procedures to assess the effectiveness of measures to prevent or reduce environmental effects during construction. Relevant local authorities and consenting authorities, such as the Environment Agency, will be consulted on the monitoring procedures to be implemented prior to construction commencement, as appropriate.

Operation of the off-route works

Introduction

2.8.25 This section describes the operational characteristics of the off-route works. Volume 1, Introduction and methodology, Section 4 describes the envisaged operational characteristics of the Proposed Scheme.

HS2 services

2.8.26 Where applicable, details are provided in the following sections of the numbers of HS2 trains that will pass through or use the stations and stabling facilities subject to off-route works and changes in service levels are noted where relevant.

Maintenance

2.8.27 Volume 1, Introduction and methodology, Section 4 describes the maintenance regime for the Proposed Scheme.

Operational waste and material resources

2.8.28 The assessment of the likely significant environmental effects associated with the disposal of operational waste has been undertaken for the Proposed Scheme as a whole and is reported in Volume 3, Route-wide effects, Section 15.

Monitoring during operation

2.8.29 The nominated undertaker will be responsible for monitoring during operation of the Proposed Scheme. General monitoring measures during operation are set out in area specific monitoring measures for each environmental topic area, which are presented in sections 3, 4 and 6 of this report.

2.8.30 Relevant local authorities and consenting authorities, such as the Environment Agency (Scottish Environmental Protection Agency, in Scotland), will be consulted on the monitoring procedures to be implemented during operation prior to construction commencement.

Committed development

2.8.31 Committed developments are defined as developments with planning permission and sites allocated for development, or safeguarded for minerals in adopted development plans, on or close to the land required for the Proposed Scheme. The committed developments are listed in Volume 5: Appendix CT-004-00000, Planning data, and are shown in Volume 5 Planning Data/Committed Development Map Book: Maps CT-13.

2.8.32 Where it is likely that committed developments will have been completed by 2025, these have the potential to alter the future baseline for the assessment of the Proposed Scheme, for example through the introduction of new receptors.

2.8.33 Where there are committed developments that are considered likely to be constructed between 2025 and 2038, i.e. at the same time as the Proposed Scheme, these have the potential to be receptors for the operation of the Proposed Scheme, but could also give rise to cumulative impacts with the Proposed Scheme during construction.

2.8.34 Details of the committed developments relevant to each of the proposed off-route works are included in Sections 3, 4 and 6 where relevant.

3 Preston Station

3.1 Overview of the area and description of the Proposed Scheme

Overview of the area

General

3.1.1 The Proposed Scheme in the Preston Station area will comprise works to the existing Preston Station. As described below, these works will include the extension of two existing platforms and reinstatement of a platform not currently used for passenger trains in order to allow HS2 trains to call at the station. The Proposed Scheme at Preston Station will be on land within Network Rail ownership.

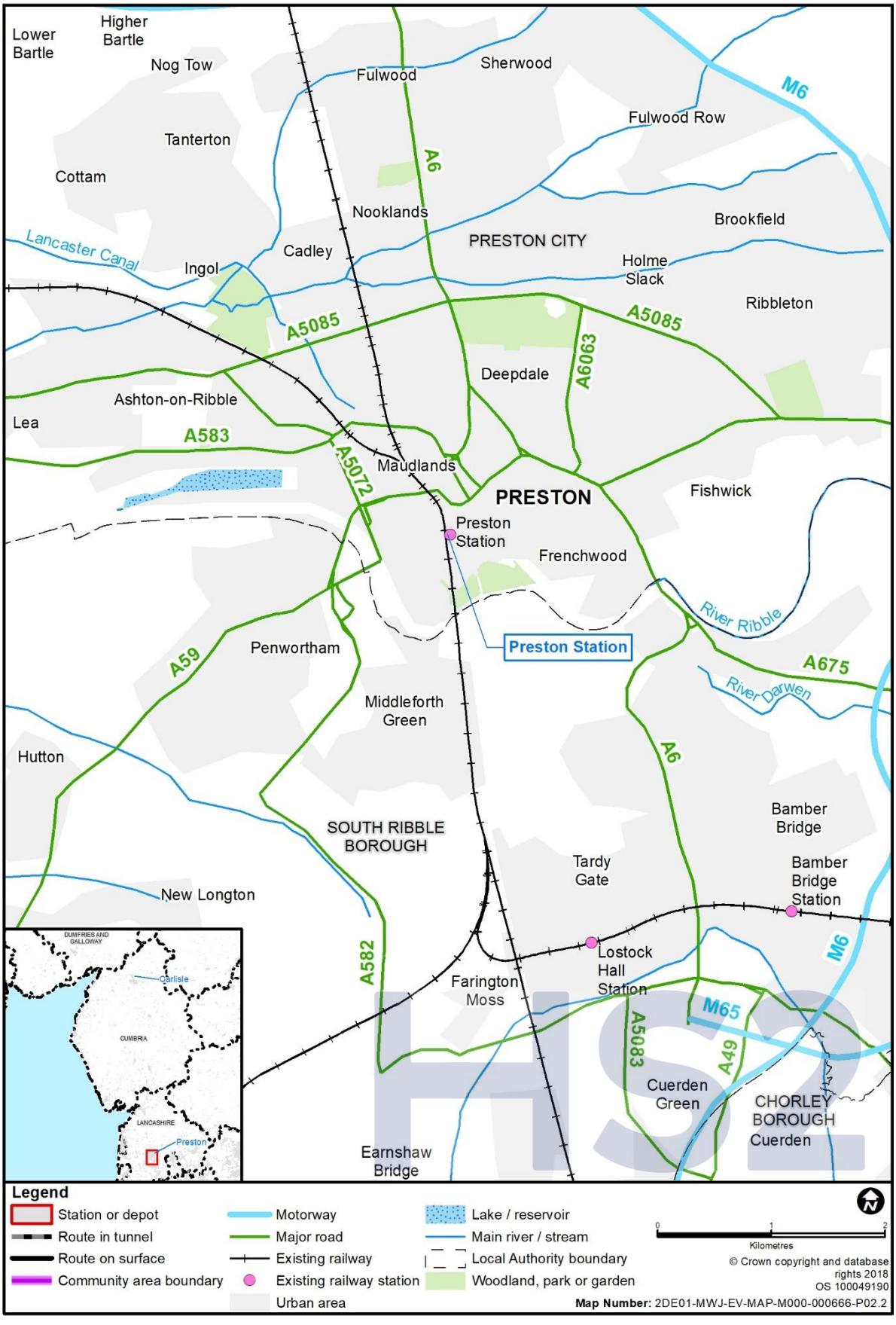
3.1.2 Preston Station is situated within Preston city centre, south of the A59 Ring Way, west of Butler Street and east of Christian Road and West Cliff. Preston City Council (PCC) and South Ribble Borough Council (SRBC) are the local authorities for the Preston Station area which lies within the county administered by Lancashire County Council (LaCC). Figure 2 shows the location of the Proposed Scheme.

Settlement, land use and topography

3.1.3 The Preston Station area is predominantly urban in character. The main land uses surrounding Preston Station are industrial, business, retail and leisure, interspersed with residential properties. The station car park, Fishergate Shopping Centre and the shopping centre car park are immediately adjacent to Preston Station to the east and there are depots operated by Network Rail and Royal Mail Group to the west.

3.1.4 The topography around Preston Station gently undulates from 10m above Ordnance Datum (AOD), south of Preston Station by the River Ribble, to approximately 20m AOD at Preston Station.

Figure 2: Preston Station area context map



Key transport infrastructure

3.1.5 Preston Station is a railway station on the West Coast Main Line (WCML), providing services to London, Birmingham, Manchester, Liverpool, Glasgow and Edinburgh. The station is also served by local trains that operate to destinations throughout Lancashire, Cumbria, Greater Manchester, Merseyside and Yorkshire.

3.1.6 The strategic highways that pass through the area are the M6 and the M65. Other principal highways within this area include the A59 Ring Way/New Hall Lane/Preston New Road, the A6 North Road/London Road, the A583 Water Lane and the A5085 Blackpool Road. Local roads include Bow Lane, Fishergate, Corporation Street, Christian Road, Butler Street, West Cliff and East Cliff.

3.1.7 Preston Bus Station provides local, regional, national and international bus and coach services. Bus services operate on routes around the city centre. Sixteen bus routes operate along Fishergate and are served by four bus stops close to the entrance to Preston Station.

3.1.8 There are also several public rights of way (PRoW) in the vicinity of Preston Station including public footpaths and bridleways adjacent to the River Ribble, approximately 350m south of Preston Station. Four national cycle routes 6, 55, 62 and 622, all part of the National Cycle Network, are also located in the vicinity of Preston Station.

Socio-economic profile

3.1.9 The professional, scientific and technical sector accounts for the largest proportion of businesses within the PCC area (13%), followed by the retail (12%) and construction (11%) sectors[7]. The construction sector accounts for the largest proportion of businesses within the SRBC area (14%), followed by the professional, scientific and technical (12%) and retail (9%) sectors.

3.1.10 According to the Annual Population Survey (2020)[8], the employment rate (the proportion of residents aged 16 – 64 in employment) within the PCC area and SRBC areas was 72% (64,200 people) and 83% (55,900 people) respectively. The unemployment rate within the PCC area was 3% and 4% in the SRBC area[9].

3.1.11 The same survey indicates that 42% of PCC area residents aged 16 – 64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, while 9% of residents had no qualifications. In the SRBC area, 39% of residents aged 16 – 64 were qualified to National

[7] Office for National Statistics (2020), *UK Business Counts - Local units by industry and employment size band 2020.* Available online at: http://www.nomisweb.co.uk/datasets/idbrlu.

[8] Office for National Statistics (2020), *Annual Population Survey*, NOMIS. Available online at: http://www.nomisweb.co.uk/datasets/apsnew. This number includes the jobs held by residents of PCC and SRBC irrespective of where they work.

[9] The date range for this statistic is January 2020 – December 2020 for all other community areas, however July 2018 - June 2019 was used for South Ribble due to data availability.

Vocational Qualification Level 4 (NVQ4) and above, while 11% of residents had no qualifications.

Notable community facilities

3.1.12 The city of Preston contains a range of shops including the Fishergate Shopping Centre, restaurants, services and community facilities including medical and educational facilities and places of worship.

3.1.13 The community facilities within the vicinity of Preston Station include medical facilities, such as Park View Surgery and Fishergate Hill Surgery.

3.1.14 Educational facilities within the vicinity of Preston Station include Imam Muhammad Zakariya School, St Stephen's Church of England Primary School and University of Central Lancashire.

3.1.15 Places of worship within the vicinity of Preston Station include St Wilfrid's Church, Church of St Walburge, Preston Central Methodist Church, Church of Our Lady of Victories, Fishergate Baptist Church, Guru Nanak Gurdwara Singh Sabha (Sikh Temple), Masjid-e-Saliheen Preston Muslim Cultural Centre, Gujarat Hindu Society and Community Centre.

Recreation, leisure and open space

3.1.16 There are a number of promoted routes (routes which are promoted in their own right as a recreational resource) in the Preston Station area including the Ribble Way which is approximately 100km long and follows the northern bank of the River Ribble, through Preston. Open spaces in the area include Avenham Conservation Area which is situated to the south-east of the station. This conservation area includes two Grade II registered parks and gardens, Miller Park and Avenham Park.

3.1.17 Recreational and leisure facilities in the Preston Station area include Harris Museum Art Gallery and Library, Frenchwood Recreation Ground, Penwortham Holme Recreation Centre, Penwortham Golf Club, Preston Sports Club, British Aircraft Corporation and English Electric Preston Social and Sports Association and several other sport fields and clubs.

Policy and planning context

3.1.18 Volume 1, Introduction and methodology provides an overview of the policy case for HS2.

Planning framework

3.1.19 Relevant development plan documents and other planning policies have been considered in relation to environmental topics, as part of considering the Proposed Scheme in the local context. Development plan documents and other planning policies relevant to the Preston Station area are listed in Volume 5: Appendix CT-004-OR001, Planning data. These have been considered and referred to where appropriate in the assessments reported in Section 3.3 of this report.

Committed development

3.1.20 Committed developments are defined as developments with planning permission and sites allocated for development, or safeguarded for minerals in adopted development plans, on or close to the land required for the Proposed Scheme. Volume 1, Introduction and methodology, Section 7 sets out the approach to identifying and considering committed developments in the assessment. The committed developments relevant to the assessment of the Proposed Scheme in the Preston Station area are listed in Volume 5: Appendix CT-004-00000, Planning data and are shown in Volume 5, Planning Data/Committed Development Map Book, Map CT-13-801.

3.1.21 These have been considered to determine whether they would result in a material change to the future baseline or have the potential to give rise to cumulative effects for each environmental topic. The committed developments considered in the assessment for the Preston Station area are reported in the relevant topic sections of this report.

Description of the Proposed Scheme

3.1.22 The following section describes the main features of the Proposed Scheme in the Preston Station area. Further general information on typical permanent features is provided in Volume 1, Introduction and methodology, Section 5. Similarly, a general description of the approach to mitigation is explained in Volume 1, Introduction and methodology, Section 9.

3.1.23 Land required for the operation of the Proposed Scheme is shown on Volume 4, Off-route effects Map Book, Map Series CT-06. Land required for the operation of the Proposed Scheme is within the existing operational railway boundary and within Network Rail's operational land. Land required for construction of the Proposed Scheme is shown on Volume 4, Off-route effects Map Book, Map Series CT-05. The area of isolated land shown on Volume 4, Off-route effects Map Book, Map CT-05-802, I2 to H3, to the north-west of Preston Station as land required for construction will be used for storage and access to the railway only and no physical works are proposed in this location.

3.1.24 The Proposed Scheme in the Preston Station area will comprise works to the existing Preston Station. These works will include the extension of two existing platforms and reinstatement of a platform not currently used for passenger trains, in order to accommodate HS2 services to call at the station. The Proposed Scheme at Preston Station will be on land within Network Rail ownership.

3.1.25 This section describes the key features and works associated with the Proposed Scheme. All dimensions in this section are approximate.

3.1.26 Key features of the Proposed Scheme are also shown on Volume 4, Off-route effects Map Book, Map CT-06-801 and Map CT-06-802 and include:

- removal of existing track and infill of bay platforms 3c and 4c;
- extension of platforms 3 and 4 by 32m and 33m in length respectively at the southern end of the station to accommodate HS2 services;

- extension of platform 3 by 13m in length at the northern end of the station to accommodate HS2 services;
- reinstatement of parcel platform (platform 0), to accommodate conventional passenger railway services;
- refurbishment and reopening of the luggage and passenger subways to provide lift and stair access for the public to platform 0;
- provision of new footbridge between platform 1 and platform 0. The new footbridge will be 22m in length and will cross over rail lines (with a minimum clearance of 5.8m). The new footbridge will provide access for passengers to the reinstated platform 0; and
- removal of a section of the canopy above platform 1 and platform 0 to accommodate the new footbridge.

3.1.27 Users of all the platforms, including the reinstated platform 0, will use the existing station entrances, ticket hall and concourse.

3.1.28 In addition, there will be modifications to the track layout, signalling, overhead line equipment and other railway systems within the Preston Station area to facilitate the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-801, D6 and Map CT-06-802, A6 to F5).

3.1.29 Construction of the Proposed Scheme will be managed from the following compounds: Parcel Sidings main compound (see Volume 4, Off-route effects Map Book, Map, CT-05-802, D5 to E5) and Butler Street satellite compound (see Volume 4, Off-route effects Map Book, Map, CT-05-802, C6 to D6). These compounds are described in this section.

Demolitions

3.1.30 No demolitions will be required to construct the permanent features or to enable the construction works for the Proposed Scheme in the Preston Station area.

Construction of the Proposed Scheme

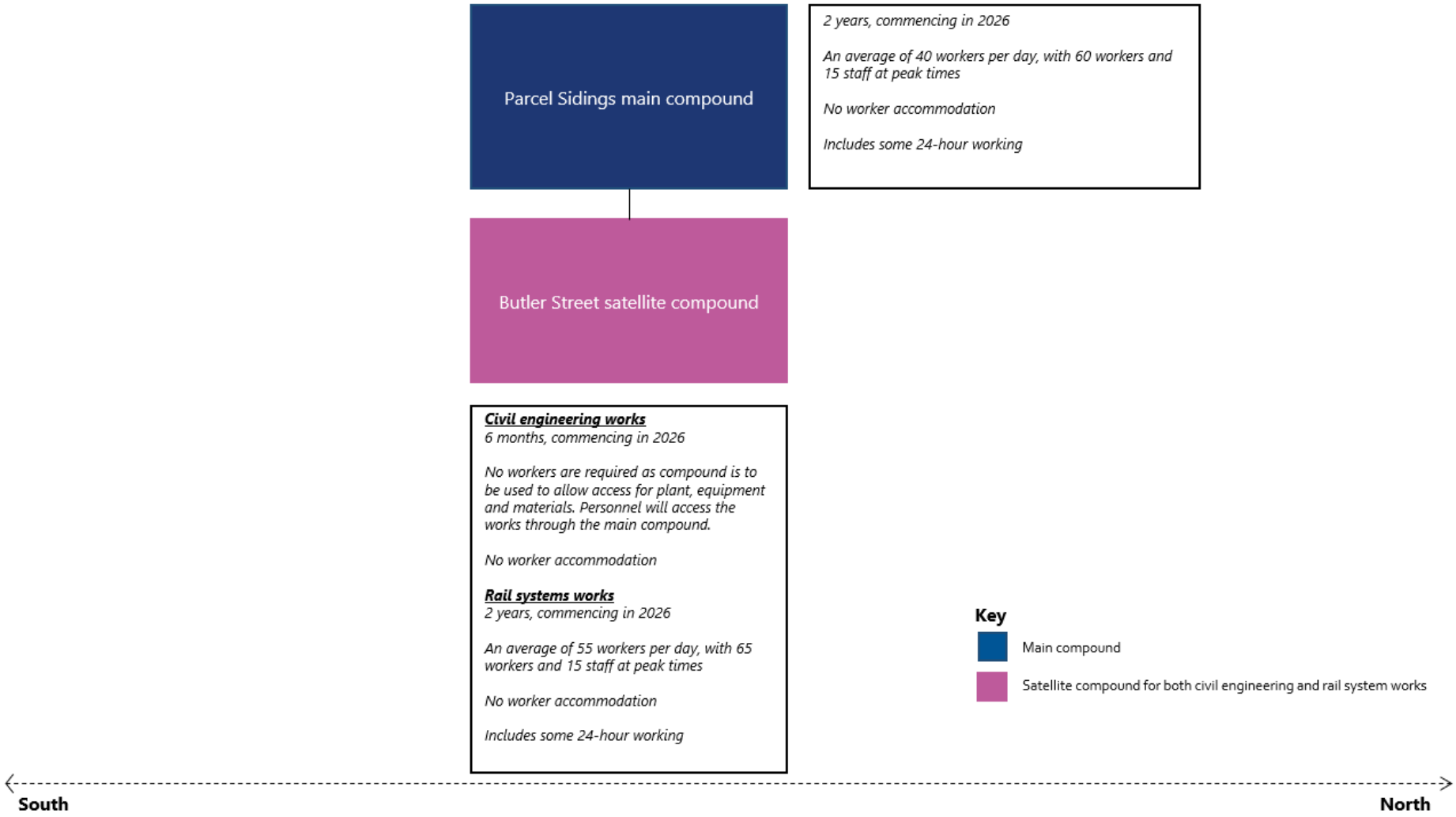
Introduction

3.1.31 Volume 1, Introduction and methodology, Section 6 provides details of the typical construction techniques which will be used to construct the Proposed Scheme. Section 2 of this report describes the typical approach to the key construction activities needed to build the Proposed Scheme. This section provides information on the construction activities that are envisaged to be needed to build the Proposed Scheme in the Preston Station area, which provide the basis for the construction assessment.

General overview of the construction compounds

3.1.32 This section provides a summary of the works to be managed from the construction compounds in the Preston Station area, as illustrated in Figure 3. All dates and durations of activities and numbers of workers are indicative. All compounds will undertake initial site set-up works, and at the end of its use, finalisation works including site reinstatement, landscaping and planting (as necessary).

Figure 3: Construction compounds for civil engineering and railway system works



Parcel Sidings main compound

3.1.33 This compound (shown on Volume 4, Off-route effects Map Book, Map CT-05-802, D5 to E5) will be used to manage civil engineering works. It will:

- provide main compound support to Butler Street satellite compound as illustrated in Figure 3; and
- be accessed via Christian Road off Fishergate (see Volume 4, Off-route effects Map Book, Map CT-05-802, E5).

3.1.34 No demolitions will be required as a result of the works to be managed from this compound.

3.1.35 The compound will be used to manage the reinstatement of the parcel platform (platform 0) which will take one year and three months to complete.

3.1.36 The compound will also be used to manage the construction of the Preston Station new footbridge between platform 1 and platform 0 which will take nine months to complete.

Butler Street satellite compound

3.1.37 This compound (shown on Volume 4, Off-route effects Map Book, Map CT-05-802, C6 to D6) will provide laydown and access for track remodelling works and general access to all works. It will:

- provide temporary access, storage and laydown and general plant access via an existing Network Rail access point, during all platform works and would be used predominantly for night possession work or track works;
- be used to manage rail system works for a period of one year and six months, followed by both civil engineering and railway systems works for a period of six months; and
- be accessed via Butler Street off Fishergate and through the station surface car park to the south-east of the Preston Station.

3.1.38 No demolitions will be required as a result of the works to be managed from this compound.

3.1.39 The compound will be used to provide access for plant and materials to support the extension works at platforms 1, 3 and 4, and infill of bay platforms 3c and 4c, which will comprise:

- the removal of existing track and infill of bay platforms 3c and 4c which will take three months to complete;
- the extension of platforms 3 and 4 at the southern end of the station which will take three months to complete; and
- the extension of platform 3 at the northern end of the station which will take three months to complete.

3.1.40 Key railway systems installation works to be managed from this compound include the modification to the track layout, signalling, overhead line equipment and other railway systems which will take one year and nine months to complete.

Construction programme

3.1.41 A construction programme illustrating indicative periods for each of the core construction activities described above is provided in Figure 4.

Figure 4: Indicative construction programme for Preston Station between 2025 and 2028

Preston Station	2025 Quarters				2026 Quarters				2027 Quarters				2028 Quarters			
Construction Activity	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Parcel Sidings main compound																
Site preparation and set-up																
Platform 0																
Preston Station new footbridge																
Site reinstatement																
Butler Street satellite compound																
Site preparation and set-up																
Platform extension 3 and 4 extension and infill																
Rail systems installation																
Site reinstatement																

Operation of the Proposed Scheme

Introduction

3.1.42 This section describes the operational characteristics of the Proposed Scheme in the Preston Station area. Volume 1, Introduction and methodology, Section 4 describes the envisaged operational characteristics of the Proposed Scheme as a whole, including Phase One, Phase 2a and Phase 2b.

HS2 services

3.1.43 It is anticipated that there will be up to four HS2 trains per hour each way serving Preston Station. Services are expected to operate between 05:00 and midnight from Monday to Saturday and between 08:00 and midnight on Sunday.

3.1.44 The trains will be either single 200m trains or two 200m trains coupled together, depending on demand and time of day.

Maintenance

3.1.45 Volume 1, Introduction and methodology, Section 4 describes the maintenance regime for the Proposed Scheme as a whole.

3.1.46 Railway infrastructure maintenance in this location will be undertaken by Network Rail as per the current provisions.

3.1.47 Train stabling and internal cleaning of trains will be undertaken at Annandale depot which is described in Section 6 of this report.

3.2 Stakeholder engagement

Introduction

3.2.1 This section summarises the approach to stakeholder engagement and consultation for the Proposed Scheme in the Preston Station area.

Consultation on the working draft ES

3.2.2 As set out in Volume 1, Introduction and methodology, Section 3, two parallel consultations were undertaken by HS2 Ltd in 2018: a consultation on the working draft ES and a consultation on the working draft EQIA. These consultations related to the full Phase 2b Scheme (including both Eastern Leg and Western Leg). As part of the process of consultation, stakeholders were invited to comment on the full Phase 2b Scheme and the working draft ES and working draft EQIA Report. Documents were made available on the gov.uk website.

3.2.3 Information events were held at locations along the route of the Proposed Scheme as part of the consultation, including at Preston Station (December 2018).

3.2.4 A total of 37,899 responses were received through the consultation on the working draft ES for the Proposed Scheme as a whole. These responses were analysed. The themes and issues relevant to the Preston Station area included commentary on:

- impacts that changes to the existing Preston Station would have on current users of the station;
- train service specifications and how HS2 would affect existing local and regional services, including concerns regarding any reduction in existing services; and
- the benefits to Preston and the wider region.

Consultation on design refinements

3.2.5 There were no design refinements consulted on in the Preston Station area, although the Proposed Scheme's design and mitigation has continued to evolve, taking into account ongoing assessment and stakeholder feedback. Further detail on the approach to

consultation and route-wide engagement is outlined in Volume 1, Introduction and methodology, Section 3.

Engagement and consultation with stakeholder groups

3.2.6 Direct engagement has been offered to and undertaken with city, borough and county councils within the Preston Station area. The purpose of this engagement was to collate local baseline information and knowledge to inform the design and assessment, identify and understand local issues and concerns, provide access to wider stakeholders and communities and provide a mechanism for ongoing dialogue and discussion on the assessment and design development.

3.2.7 Engagement has also focused on the technical areas that inform the assessment, including the historic environment, sound, noise and vibration and traffic and transport, amongst others. Briefings were offered to specialist and technical stakeholders across the Proposed Scheme during the period of consultation on the working draft ES and as part of the route-wide update between October and November 2020 (using online channels) to provide information on the evolving design and assessment of the Proposed Scheme in their respective areas.

3.2.8 As part of the route-wide update between October and November 2020 and an additional route-wide update between June and July 2021, targeted engagement was also offered to those stakeholders who have land, property or business operations directly affected by the construction and operation of the Proposed Scheme to meet (using online channels where necessary) with technical experts to gain a better understanding of emerging design and share their thoughts on how this might affect them. Members of local communities and other interested parties were also invited to engage on issues pertinent to the development of the Proposed Scheme design and its assessment.

3.2.9 Engagement has been undertaken with major asset owners and businesses within the Preston Station area including Royal Mail Group. The purpose of this engagement has been to obtain baseline information and provide these stakeholders with the opportunity to raise issues and discuss mitigation in relation to the Proposed Scheme.

3.2.10 HS2 Ltd has offered to engage with all relevant MPs during the development of the Proposed Scheme in order to discuss key issues and concerns.

3.2.11 Table 1 summarises key engagement undertaken with all stakeholders relating to the Preston Station area to date, including local authorities, statutory bodies, specialist organisations and community stakeholders. This includes a summary of the focus of the engagement and how this has informed the design and assessment of the Proposed Scheme.

Table 1: Engagement to date with stakeholders

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Local authority	Lancashire County Council	Series of meetings to discuss the Proposed Scheme, provide updates on consultation activities and understand potential impacts on the local community. Key discussion points included: • impacts on users of the station and on local traffic and transport links during construction; • effects on the existing local and regional train services; and • economic regeneration opportunities.	Feedback used to improve understanding of baseline conditions, potential impacts and proposed mitigation concerns and opportunities for the Preston Station area.
Local authority	Preston City Council	Series of meetings to discuss the Proposed Scheme, provide updates on consultation activities and understand potential impacts on the local community. Key discussion points included: • impacts on users of the station and on local traffic and transport links during construction; • effects on the existing local and regional train services; and • economic regeneration opportunities.	Feedback used to improve understanding of baseline conditions, potential impacts and proposed mitigation concerns and opportunities for the Preston Station area.
Local authority	South Ribble Borough Council	Briefing to provide an update on the development of the Proposed Scheme and to gather any feedback in regard to this.	Information used to improve understanding of baseline conditions and provide an opportunity to consider any mitigation that may be required.
Statutory and national	Environment Agency	Land quality, water and flood risk issues.	Informed land quality, water resources, surface water flood risk and Water Framework Directive methodology. Improved understanding of baseline conditions for the Proposed Scheme and the proposed mitigation.
Statutory and national	Highways England	Strategic road network, traffic and transport issues.	Informed the assessment of road network capacity and identification of proposed future works by Highways England.

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Statutory and national	Historic England	Nationally designated heritage assets and the heritage assessment methodology.	Informed methodology for assessing setting and impacts on historic landscape at national and regional level. Following engagement with Historic England, impacts on heritage assets were scoped out of the assessment for the Preston Station area.
Statutory and national	Natural England	Ecology, agricultural, land quality and landscape and visual related issues.	Provided information regarding the natural environment on a route-wide basis. Informed methodological approach and detailed local conditions and factors to be taken into consideration in the assessment and opportunities for mitigation. Following engagement with Natural England, ecological, agricultural, land quality and landscape and visual impacts were scoped out of the assessment for the Preston Station area.
Statutory and national	Network Rail	Rail infrastructure.	Informed route-wide considerations around rail infrastructure network and factors to be considered in the design and assessment of the Proposed Scheme, including the changes required to Preston Station to accommodate HS2.
Local authority technical meetings	Lancashire County Council and Preston City Council	Meeting to discuss the ecology and biodiversity assessment including the mitigation strategy.	Information used to improve understanding of local conditions and factors to inform the design of the Proposed Scheme and assessment.
Local authority technical meetings	Lancashire County Council and Preston City Council	Meetings with technical leads to discuss the historic environment assessment.	Information used to improve understanding of local conditions and factors to inform the design of the Proposed Scheme and assessment, including consideration of the Grade II listed Preston Station.

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Local authority technical meetings	Lancashire County Council and Preston City Council	Meetings to discuss landscape and visual impact impacts including viewpoint locations.	Information used to improve understanding of local conditions and factors to inform the design of the Proposed Scheme and assessment.
Local authority technical meetings	Lancashire County Council and Preston City Council	Meeting to discuss the sound, noise and vibration and air quality assessment including proposed mitigation.	Information used to improve understanding of local conditions and factors to inform scheme design and assessment relating to sound, noise and vibration.
Local authority technical meetings	Lancashire County Council and Preston City Council	Meetings to provide information on the Proposed Scheme and obtain relevant baseline information and discuss transport survey requirements and assessment methodology relating to traffic and transport.	Improved understanding of local traffic flows, highways operations and future proposals and informed the emerging design and assessment of the Proposed Scheme.

3.3 Environmental assessment

Introduction

3.3.1 This section reports the environmental assessment undertaken for the Proposed Scheme in the Preston Station area.

Scope, assumptions and limitations

3.3.2 The following environmental topics have been identified as relevant to the assessment of Preston Station: air quality; historic environment; socio-economics; sound, noise and vibration; and traffic and transport. An assessment of the potential likely significant effects for these topics is reported below. All other topics were scoped out on the basis that the Proposed Scheme will not give rise to the potential for likely significant effects.

3.4 Air quality

Introduction

3.4.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction of the Proposed Scheme within the Preston Station area. Oxides of nitrogen (NO_x) including nitrogen dioxide (NO_2), fine particulate matter (particles of size less than 2.5µm and 10µm in diameter, referred to as $PM_{2.5}$ and PM_{10}, respectively) and dust have been considered in the assessment. Emissions of all or

some of these air pollutants are likely to arise from construction activities, demolition and site preparation works. Emissions will also arise from road traffic during construction of the Proposed Scheme.

3.4.2 Engagement with Preston City Council (PCC) has been undertaken. The purpose of this engagement has been to obtain relevant baseline information, which includes monitoring data in this area.

3.4.3 Detailed reports on the air quality data and assessments for this area are contained within Volume 5: Appendix AQ-001-OR001. Additional information on air quality monitoring used in the assessment is set out in Background Information and Data (BID), BID AQ-002-OR001[10].

3.4.4 Maps showing the location of the key environmental features and the key construction features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 3.1.

3.4.5 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

3.4.6 The scope, assumptions and limitations for the air quality assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report (SMR)[11] and Volume 5: Appendix AQ-001-OR001. No significant effects on air quality are anticipated during the operation of the Proposed Scheme. The operation of the Proposed Scheme has therefore been scoped out and is not considered in the assessment.

3.4.7 The study areas for the air quality assessment have been determined on the basis of where impacts on local air quality may occur:

- from construction activities;
- from changes in the nature of traffic during construction; for example, increases in traffic flows during construction or where road closures or restrictions cause diversions and heavier traffic on adjacent roads; or
- from changes to road alignment.

3.4.8 The assessment of construction dust emissions has been undertaken for sensitive receptors located up to 350m from dust generating activities. The assessment of traffic emissions has been undertaken for sensitive receptors located up to 200m from roads screened in for further assessment.

[10] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[11] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

3.4.9 The assessment has incorporated HS2 Ltd's policies on vehicle emissions[12]. These include the use of Euro VI heavy goods vehicles (HGV), Euro 4 petrol and Euro 6 diesel cars and light goods vehicles (LGV) during construction of the Proposed Scheme.

3.4.10 The assessment of construction traffic impacts has used traffic data based on an estimate of the average daily flows in the peak year during the construction period. The assessment assumes vehicle emission rates and background pollutant concentrations from year 2025, as the first year of construction for the full Proposed Scheme as set out in Volume 1, Introduction and methodology. As both pollutant emissions from vehicle exhausts and background pollutant concentrations are anticipated to reduce year by year as a result of vehicle emission controls, the year 2025 represents the worst case for the construction assessment.

Environmental baseline

Existing baseline

Background air quality

3.4.11 The main sources of air pollution in the Preston Station area are emissions from road vehicles. The main roads within the area are the A59 Ring Way/New Hall Lane/Preston New Road, Bow Lane, Fishergate, Corporation Street, Christian Road and Butler Street.

3.4.12 There are no industrial installations (regulated by the Environment Agency) with permits for emissions to air. The contribution of all industrial processes and other emission sources to local air quality is included within the background concentrations.

3.4.13 Estimates of background air quality have been taken from the Department for Environment, Food and Rural Affairs (Defra)[13] for the baseline year of 2018. The data are estimated for 1km grid squares for NO_x, NO_2, PM_{10} and $PM_{2.5}$. Background concentrations were within the air quality standards for all pollutants within the Preston Station area.

Local monitoring data

3.4.14 There are currently nine local authority diffusion tube sites located within 1km of the Preston Station area for monitoring NO_2 concentrations. These are located on the A59 Ring Way, the A59 New Hall Lane and the A6 London Road.

3.4.15 There are also two continuous air quality monitoring sites within the Preston Station area for monitoring NO_2 concentrations. One is a roadside site on Meadow Street and the other, an urban background site on Bootle Street, which also monitors $PM_{2.5}$.

[12] High Speed Two Ltd (2022), *Phase 2b Western Leg Information Paper E14: Air quality*.

[13] Department for Environment, Food and Rural Affairs (2020), *Defra Background Pollutant Concentration Maps.* Available online at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018.

3.4.16 Measurements of NO_2 were within the air quality standard at all but one location in 2018. At the A59 New Hall Lane, annual mean NO_2 concentrations were above the air quality standard in 2018. Measurements of $PM_{2.5}$ were within the air quality standard at the location monitored.

3.4.17 The monitoring data are presented in Volume 5: Appendix AQ-001-OR001 and BID AQ-002-OR001.

Air quality management areas

3.4.18 There are five air quality management areas (AQMA) within the PCC area: the Preston AQMA No.1 to No.5.

3.4.19 The Preston AQMA No.1 covers an area encompassing a number of properties between Church Street and Percy Street, adjacent to the junctions of these roads and the A6 London Road/A59 Ring Way and was declared in September 2005. The Preston AQMA No.2 covers an area encompassing a number of properties in the vicinity of the junction of the A5085 Blackpool Road and Plungington Road and was declared in September 2005. The Preston AQMA No.3 covers an area incorporating part of Garstang Road, Broughton, Preston, and was declared in May 2012. The Preston AQMA No.4 covers part of the A59 New Hall Lane and was declared in May 2012. The Preston AQMA No.5 covers the A6 London Road and was declared in March 2014.

3.4.20 All AQMA have been designated for exceedances of the annual mean NO_2 standard. Details of their locations are presented in Volume 5: Appendix AQ-001-OR001.

Receptors

3.4.21 Several locations have been identified in the area as sensitive receptors, which are considered to be susceptible to changes in air quality due to their proximity to dust generating activities or traffic routes during construction of the Proposed Scheme.

3.4.22 Most of the receptors which may be affected by the Proposed Scheme are residential.

3.4.23 The air quality assessment has also included receptors in ecological sites sensitive to nitrogen deposition and dust. There are no international/national designated ecological sites of relevance to the air quality assessment identified in the Preston Station area. Other relevant local sensitive ecological sites identified close to the Proposed Scheme include Preston Junction Local Nature Reserve (LNR).

Future baseline

3.4.24 Volume 5: Appendix CT-004-OR001 provides details of the developments in the Preston Station area that are assumed to be implemented prior to construction. The potential cumulative impact from committed developments on air quality in conjunction with the effects from the construction of the Proposed Scheme has been considered as part of this

assessment. The future air quality baseline is defined as the 'without the Proposed Scheme' scenario.

Construction (2025)

3.4.25 Future background pollutant concentrations have been sourced from the Defra background maps for the first year of construction in 2025, which predict NO_2, PM_{10} and $PM_{2.5}$ levels in 2025 to be lower than in the 2018 baseline and within the relevant air quality standards.

3.4.26 Committed developments that have been included as future receptors in the assessment of air quality impacts during construction of the Proposed Scheme are identified in Volume 5: Appendix AQ-001-OR001. No additional committed developments have been identified in this study area that will materially alter the baseline conditions in 2025 for air quality.

Effects arising during construction

Avoidance and mitigation measures

3.4.27 Emissions to the atmosphere will be controlled and managed during construction through the route-wide implementation of the Code of Construction Practice (CoCP). The draft CoCP[14] includes a range of mitigation measures that are accepted by the Institute of Air Quality Management (IAQM) as being suitable to reduce impacts to as low a level as is reasonably practicable. These measures are generally sufficient to avoid any significant effects from dust during construction.

3.4.28 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP will be implemented. These include:

- contractors being required to manage dust, air pollution, odour and exhaust emissions during construction works;
- inspection and visual monitoring, undertaken in consultation with the local authorities, to assess the effectiveness of the measures taken to control dust and air pollutant emissions;
- cleaning (including watering) of vehicle routes and designated vehicle waiting areas to suppress dust;
- the use of water spray systems on demolition sites to dampen down fugitive dust;
- keeping soil stockpiles away from sensitive receptors where reasonably practicable, also taking into account the prevailing wind direction relative to sensitive receptors;
- the use of enclosures to contain dust emitted from construction activities; and
- soil spreading, seeding and planting of completed earthworks as soon as reasonably practicable following completion of earthworks.

[14] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

3.4.29 Prior to commencement of activities, there will be further detailed assessment for each worksite to determine site specific dust mitigation.

Assessment of impacts and effects

Temporary effects

3.4.30 Impacts from construction of the Proposed Scheme could arise from dust generating activities and emissions from construction traffic. As such, the assessment of construction impacts has been undertaken for dust and exposure to NO_2, PM_{10} and $PM_{2.5}$ concentrations.

Construction dust effects

3.4.31 The risks of demolition of existing structures, earthworks, construction of new structures and trackout have been assessed for their effect on dust soiling, human health[15] and ecological sites. Trackout refers to the transport of dust and dirt from the construction site(s) onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The human health effects of dust relate mainly to short-term exposure to PM_{10}.

3.4.32 The identified risks potentially arising from construction dust within the Preston Station area are shown in Table 2. The risks are dependent on the magnitude of dust generating activities and the location of sensitive receptors in relation to these activities.

Table 2: Summary of risks for construction dust assessment

Activity	Dust soiling	Human health	Ecological effects
Demolition	Medium	Negligible	Not applicable
Earthworks	Not applicable	Not applicable	Not applicable
Construction	Low	Low	Negligible
Trackout	Medium	Low	Not applicable

3.4.33 With the application of the established national best practice mitigation measures contained in the draft CoCP, no significant effects are anticipated from the risks associated with the dust generating activities. Further details of the assessment can be found in Volume 5: Appendix AQ-001-OR001 where the scale of dust emissions and the sensitivity of the area and receptors are fully described.

Construction traffic effects

3.4.34 Construction activity could also affect local air quality through the additional traffic generated on the highway network as a result of construction vehicles, and through changes to traffic patterns arising from temporary road diversions and realignments.

[15] Human health effects relate mainly to short-term exposure to particles of size between 2.5µm to 10µm, measured as PM_{10}.

3.4.35 The assessment of construction traffic emissions has been undertaken for a 'without the Proposed Scheme' scenario and a 'with the Proposed Scheme' scenario. The traffic data for each scenario includes the additional traffic from future committed developments.

3.4.36 Construction traffic data in the study area have been screened to identify roads that required further assessment, and to confirm the likely effect of the change in emissions from vehicles using those roads during construction of the Proposed Scheme. Following a review of the traffic data, no roads have been identified for further assessment in this area. Therefore, no significant effects are anticipated for air quality during construction of the Proposed Scheme.

Permanent effects

3.4.37 No permanent effects on local air quality are likely to arise during construction of the Proposed Scheme.

Other mitigation measures

3.4.38 No other mitigation measures are considered necessary in relation to air quality during construction of the Proposed Scheme in this area.

Summary of likely residual significant effects

3.4.39 The methods outlined within the draft CoCP are considered effective at reducing dust emissions, and therefore, no significant residual effects are anticipated.

Cumulative effects

3.4.40 The data used in the air quality assessment take account of predicted changes in traffic as a result of committed developments in the area, and therefore, their impacts have been included within the assessment. It is assumed that dust emissions from construction of other developments in the area will be controlled by appropriate measures as set out within their respective environmental management controls, and therefore, no cumulative effects for air quality are anticipated.

3.5 Historic environment

3.5.1 No significant effects are predicted for the historic environment in relation to Preston Station, however relevant baseline data have been included in BID HE-001-OR001 to provide baseline reporting and an assessment of the less than significant effect. This approach has been adopted due to the Grade ll listed status of Preston Station.

3.6 Socio-economics

Introduction

3.6.1 This section reports on the environmental baseline, likely economic and employment impacts, as well as significant effects during construction and operation of the Proposed Scheme within the Preston Station area. The assessment considers existing businesses, community organisations, local employment and local economies, including planned growth and development.

3.6.2 The socio-economic effects on employment at a route-wide level are reported in Volume 3, Route-wide effects, Section 12. Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 3.1.

Scope, assumptions and limitations

3.6.3 The scope, assumptions and limitations for the socio-economics assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report[16]. The assessment of in-combination effects draws on the findings of other technical disciplines (e.g. air quality, sound, noise and vibration, and traffic and transport).

Environmental baseline

Existing baseline

Study area description

3.6.4 The following provides a brief overview of employment, economic structure, labour market and business premises availability within the Preston Station area which lies within the administrative areas of Preston City Council (PCC) and South Ribble Borough Council (SRBC) and within the North West region.

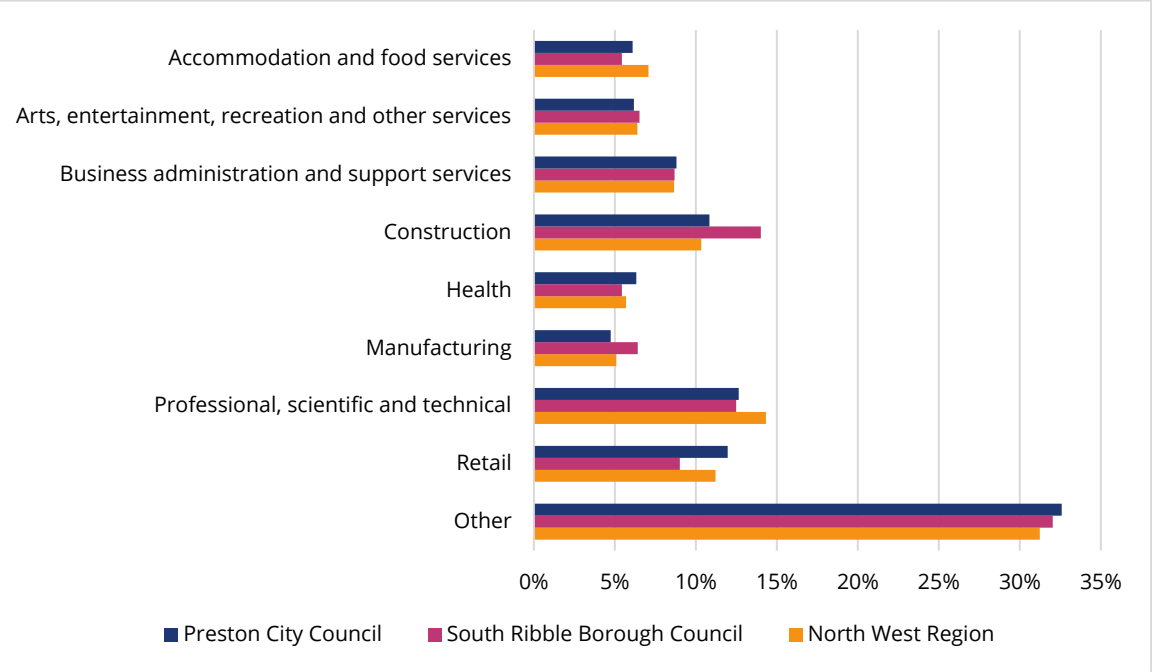
Business and labour market

3.6.5 Within the PCC and SRBC administrative areas there is a wide spread of business types reflecting a diverse range of commercial activities. In the PCC area in 2020, the professional, scientific and technical sector accounted for the largest proportion of businesses (13%), with retail the second largest (12%), followed by construction (11%) and business administration and support services (9%).

[16] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report.*

3.6.6 In the SRBC area in 2020, the construction sector accounted for the largest proportion of businesses (14%), with professional, scientific and technical the second largest (12%), followed by retail (9%) and business administration and support services (9%), as shown in Figure 5. By comparison, the largest sectors in the North West region were professional, scientific and technical (14%) and retail (11%), followed by construction (10%) and business administration and support services (9%)[17].

Figure 5: Business sector composition in the Preston City Council and South Ribble Borough Council areas and the North West Region



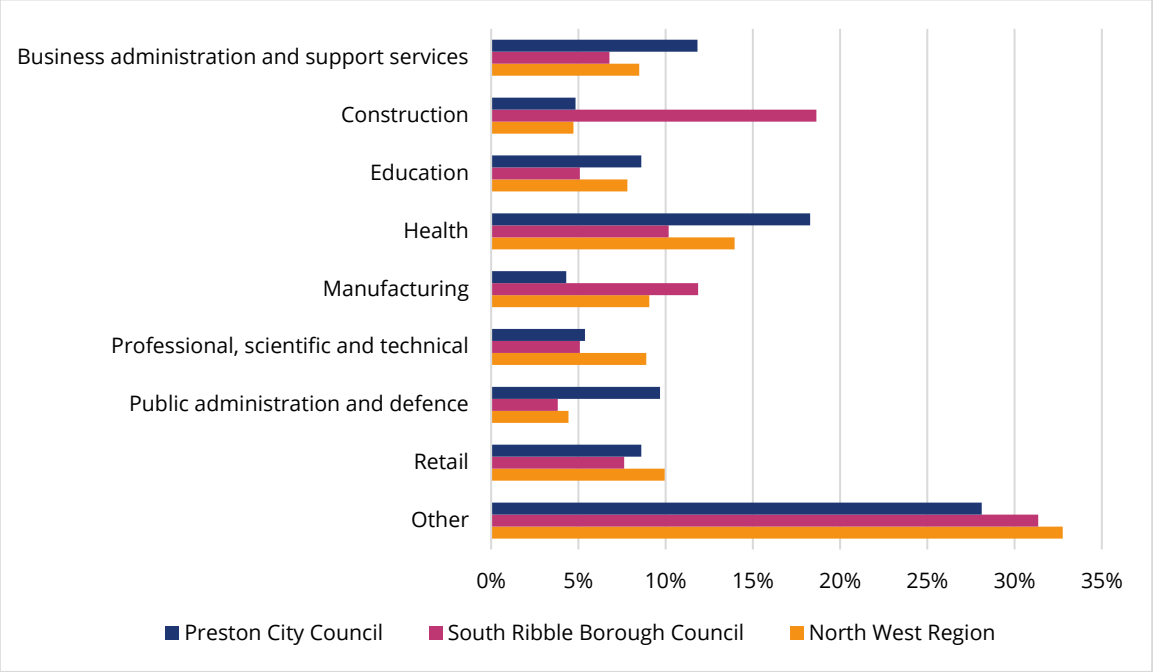
3.6.7 In 2019[18], approximately 93,000 people worked in the PCC area. According to the Office for National Statistics Business Register and Employment Survey 2019, the top five sectors in terms of share of employment were: health (18%); business administration and support services (12%); public administration and defence (10%); retail (9%); and education (9%).

3.6.8 In 2019, approximately 59,000 people worked in the SRBC area. The top four sectors in terms of share of employment were: construction (19%); manufacturing (12%); health (10%); and retail (8%). These compare with the top four sectors for the North West region, which were: health (14%); retail (10%); manufacturing (9%); and professional, scientific and technical (9%), as shown in Figure 6.

[17] Office for National Statistics (2020), *UK Business Counts – local units by industry and employment size band 2020*. Available online at: http://www.nomisweb.co.uk/datasets/idbrlu.

[18] Office for National Statistics (2019), *Business Register and Employment Survey: open access* 2019. Available online at: http://www.nomisweb.co.uk/datasets/newbres6pub. This number includes both residents and non-residents of PCC and SRBC who work within its boundaries.

Figure 6: Employment by industrial sector in the Preston City Council and South Ribble District Council areas and the North West Region



3.6.9 According to the Annual Population Survey (2020)[19], the employment rate[20] within the PCC area was 72% (64,200 people), and 83% (55,900 people) in the SRBC area, which compares to that recorded in the North West region (74%) and England (76%). In 2020, unemployment in the PCC area was 2.5% and 4.4%[21] in the SRBC area, compared with the North West region (4.3%) and England (4.8%).

3.6.10 The Annual Population Survey (2020)[19] also shows that 42% of PCC and 39% of SRBC residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, which compares to that recorded in the North West (39%) and England (43%), while 9.1% of PCC residents and 10.6% of SRBC residents had no qualifications, which was higher than that recorded both for the North West region (7.5%) and England (6.2%).

Future baseline

Construction (2025)

3.6.11 Volume 5: Appendix CT-004-OR001 provides details of the developments in the Preston Station area that are assumed to have been implemented by 2025. The following committed

[19] Office for National Statistics (2020), *Annual Population Survey*. Available online at: http://www.nomisweb.co.uk/datasets/apsnew. This number includes the jobs held by residents of PCC and SRBC irrespective of where they work.

[20] The proportion of working age (16 – 64 year olds) residents that are in employment.

[21] The date range for this statistic is January 2020 - December 2020 for all other local authorities, however July 2018 - June 2019 was used for the South Ribble unemployment rate due to data unavailability.

development of relevance to socio-economics that would materially alter the future baseline during construction of the Proposed Scheme in this area, is set out in Table 3.

Table 3: Committed development of relevance to socio-economics during construction

Map book reference[22]	Planning reference	Description	How this is considered in the assessment
PSTN/012	LCC/2016/0085	Location: 8 East Cliff, Preston, PR1 3JE. Change of use/conversion/extension of the former Park Hotel building from offices (Class B1) back to a hotel (Class C1) to include a new build single-storey pavilion building and demolition of the existing JDO office building and its replacement with a six storey office building/extension to the hotel. Change of use/conversion/part demolition and rebuild of no. 8 East Cliff from offices (Class B1) to health spa (Class D1). Alongside remodelling of existing car parking and landscaping works (Article 16 Consultation).	Informing future baseline.

3.6.12 Implementation of committed development PSTN/012 could result in the loss of jobs, altering the future baseline against which the Proposed Scheme is assessed. As such, this committed development has been included as part of the future baseline and considered within this assessment.

3.6.13 The existing composition and numbers of employers, employees and economic sectors in the area is likely to change over time in ways that cannot be accurately forecast.

Operation (2038)

3.6.14 Volume 5: Appendix CT-004-OR001 also provides details of the developments in the Preston Station area that are assumed to have been implemented by 2038. No additional committed developments of relevance for socio-economics have been identified that would materially alter the future baseline in this area.

Effects arising during construction

Avoidance and mitigation measures

3.6.15 The draft Code of Construction Practice (CoCP)[23] includes a range of provisions that will help mitigate socio-economic effects associated with construction within this area, including:

- reducing nuisance through the sensitive layout of construction sites (Section 5);
- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (Section 12);

[22] Volume 5: Planning Data/Committed Development Map Book: Map CT-13-801.

[23] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP).*

- applying best practicable means during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses) (Section 13);
- monitoring and managing flood risk and other extreme weather events that may affect socio-economic resources during construction (Section 16);
- site-specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (Section 14); and
- maintaining access to businesses for the duration of construction works where reasonably practicable (Section 14).

Assessment of impacts and effects

Temporary effects

In-combination effects

3.6.16 No businesses have been identified within the Preston Station area that are expected to experience significant in-combination effects as a result of the Proposed Scheme.

Isolation

3.6.17 No businesses have been identified within the Preston Station area that are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

3.6.18 There will be one main civil engineering compound (Parcel Sidings main compound) and one civil engineering satellite compound in the Preston Station area. The satellite compound will continue to be used as a railway systems compound following the completion of civil engineering works. Up to 230 person years of construction employment opportunities will be created at these sites[24], broadly equivalent to 20 full-time jobs[25]. Depending on the skill levels required and the skills of local people, these jobs are potentially accessible to residents in the locality and to others living further afield. The impact of the direct construction employment creation has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).

3.6.19 Direct construction employment could lead to opportunities for local businesses to supply the Proposed Scheme or to benefit from expenditure of construction workers. The impact of indirect construction employment creation has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).

[24] Construction labour is reported in construction person years, where one construction person year represents the work done by one person in a year composed of a standard number of working days.

[25] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

3.6.20 The resulting effects on construction employment are reported in aggregate at a route-wide level (see Volume 3, Route-wide effects).

Permanent effects

Businesses

3.6.21 Businesses directly affected, comprising those that lie within land required for the Proposed Scheme, are reported in groups, where possible, to form defined resources based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier, or that similar businesses and resources are clustered together.

3.6.22 The Proposed Scheme is not expected to result in the displacement or possible loss of jobs within this area and hence no significant direct effects are expected.

Other mitigation measures

3.6.23 Businesses displaced by the Proposed Scheme will be compensated in accordance with the Compensation Code. HS2 Ltd recognises the importance of businesses displaced from their existing premises being able to relocate to suitable alternative premises and will, therefore, offer additional support over and above statutory requirements to facilitate this process[26],[27]. Businesses with an interest in land that is either being acquired or possessed temporarily for the construction of the Proposed Scheme may also be eligible for compensation in accordance with the Compensation Code.

3.6.24 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents in the Preston Station area in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that promotes further economic growth across the UK.

Summary of likely residual significant effects

3.6.25 There are no significant effects identified in the assessment that will arise during construction of the Proposed Scheme.

Cumulative effects

3.6.26 No significant cumulative temporary or permanent effects during construction have been identified.

[26] High Speed Two Ltd (2022), *Phase 2b Western Leg Information Paper C7: Business relocation*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[27] High Speed Two Ltd (2022), *Phase 2b Western Leg Information Paper C8: Compensation code for compulsory purchase.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

Effects arising from operation

Avoidance and mitigation measures

3.6.27 No mitigation measures are proposed in relation to business resources during operation of the Proposed Scheme.

Assessment of impacts and effects

3.6.28 No resources are expected to experience significant direct socio-economic, in-combination or isolation effects during the operation of the Proposed Scheme.

Operational employment

3.6.29 Operational employment will be created at locations along the route including stations, train crew facilities and infrastructure/maintenance depots. Within the Preston Station area there will be 750 HS2-related train crew jobs based at the existing station. These employment opportunities will be accessible to residents within the locality.

3.6.30 Direct operational employment created by the Proposed Scheme could also lead to indirect employment opportunities for local businesses in terms of supplying the project or benefiting from expenditure of directly employed workers on goods and services.

3.6.31 Some of these employment opportunities will be accessible to residents in the locality and, given the transport accessibility within the local area, to residents living further afield.

3.6.32 The impact of operational employment creation has been assessed as part of the route-wide assessment (see Volume 3, Route-wide effects).

Other mitigation measures

3.6.33 No further mitigation measures have been identified for socio-economic receptors.

Summary of likely residual significant effects

3.6.34 There are no significant effects arising during operation of the Proposed Scheme.

Cumulative effects

3.6.35 No significant cumulative effects on socio-economic receptors have been identified in the Preston Station area during operation of the Proposed Scheme.

Monitoring

3.6.36 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

3.6.37 On the basis of there being no significant residual operational effects, there are no area-specific requirements for monitoring socio-economic effects during the operation of the Proposed Scheme in the Preston Station area.

3.7 Sound, noise and vibration

Introduction

3.7.1 This section reports the assessment of the noise and vibration likely significant effects arising from the construction and operation of the Proposed Scheme within the Preston Station area on:

- residential receptors such as people, primarily where they live, in terms of individual dwellings and on a wider community basis including any shared community open areas; and
- non-residential receptors such as:
  - community facilities including schools, hospitals, places of worship and quiet areas; and
  - commercial properties such as hotels.

3.7.2 'Shared community open areas' are those that the Planning Practice Guidance[28] identifies may partially offset a noise effect experienced by residents at their dwellings and are either a) relatively quiet nearby external amenity spaces for sole use by a limited group of residents as part of the amenity of their dwellings or b) a relatively quiet external publicly accessible amenity space (e.g. park or local green space) that is nearby.

3.7.3 Non-residential receptors with multiple uses were assessed either based on the most noise sensitive use or were subject to multiple assessments as appropriate.

3.7.4 'Quiet Areas' are defined in the EIA Scope and Methodology Report (SMR)[29] as:

- areas designated under Local Plans as being prized for their tranquillity;
- areas designated under Local Plans or Neighbourhood Development Plans as Local Green Spaces; and
- areas identified as Quiet Areas through implementation of the Environmental Noise (England) Regulations 2006[30,31].

[28] Ministry of Housing, Communities and Local Government (2014), National Planning Practice Guidance – Noise. Available online at: https://www.gov.uk/guidance/noise--2.

[29] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

[30] *The Environmental Noise (England) Regulations 2006 (SI 2006/2238).* Her Majesty's Stationery Office, London. Available online at https://www.legislation.gov.uk/uksi/2006/2238.

[31] *The Environmental Noise (England) (Amendment) Regulations 2009 (SI 2009/1610).* Available online at https://www.legislation.gov.uk/uksi/2009/1610.

3.7.5 The methodology for the assessment of likely significant noise and vibration effects was developed in line with UK Government noise policy[32], planning policy, planning practice guidance on noise (PPGN)[33] and Environmental Impact Assessment (EIA) Regulations as described in the SMR[29].

3.7.6 Engagement has been undertaken with Preston City Council with respect to the sound, noise and vibration assessment. The purpose of this engagement has been twofold. Engagement has been undertaken covering matters including process, scope, method, approach to baseline and mitigation strategy. Officers from local and county authorities have been invited to attend and witness baseline sound measurements. Where appropriate, relevant information identified by the authorities has been taken into account in the assessment. Engagement with local and county authorities will continue as part of the development of the Proposed Scheme.

3.7.7 More detailed information regarding the sound, noise and vibration assessment for the Preston Station area is available in Volume 5:

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-00000); and
- sound, noise and vibration, baseline and construction assessment (Appendix SV-001-OR001).

3.7.8 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. Mapping to support the sound, noise and vibration assessment is presented in Map Series SV-03 (Volume 5, Sound, noise and vibration Map Book). The Proposed Scheme is described in Section 3.1.

3.7.9 The assessment of likely significant effects from noise and vibration on socio-economics is presented in the socio-economic assessments reported in this section respectively.

3.7.10 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

3.7.11 The scope, assumptions and limitations for the sound, noise and vibration assessment are set out in Volume 1, Introduction and methodology, Section 8 and the SMR[29] and Volume 5: Appendix SV-001-00000.

3.7.12 The approach to assessing sound, noise and vibration and identifying envisaged mitigation is outlined in Volume 1, Introduction and methodology, Section 8 and Section 9, and the SMR.

[32] Department for Environment, Food and Rural Affairs (Defra) (2015), *Noise Policy Statement for England*. Available online at: https://www.gov.uk/government/publications/noise-policy-statement-for-england.

[33] Department for Communities and Local Government (DCLG) (2019), *Planning Practice Guidance – Noise.* Available online at: https://www.gov.uk/guidance/noise--2.

3.7.13 In this assessment 'sound' is used to describe the acoustic conditions that people experience as a part of their everyday lives. Noise is taken as unwanted sound and hence adverse effects are noise effects and mitigation is, for example, by noise barriers.

3.7.14 The assessment of construction vibration has been undertaken for residential and non-residential receptors located up to 85m from the nearest construction activity, and up to 200m for non-residential receptors/land uses where low ambient vibration or sound is critical to operations. The assessment of construction noise has been undertaken for residential and non-residential receptors located up to 300m from the nearest construction activity or the area within which the sound levels are forecast to give rise to potential impacts, whichever is greater.

3.7.15 The construction arrangements that form the basis of the assessment are presented in Section 3.1 of this report, in Volume 1, Introduction and methodology, Section 8 and in the draft Code of Construction Practice (CoCP)[34].

3.7.16 The assessment takes account of people's sensitivity to noise during the day, evening and night-time[35]. More stringent criteria are applied during evening and night-time periods, compared to the busier and more active daytime period.

3.7.17 It is likely that the majority of receptors adjacent to the Proposed Scheme are not currently subject to appreciable vibration[36]. The predicted vibration levels at all receptors as a result of the Proposed Scheme has, therefore, been assessed using specific absolute thresholds, below which receptors will not be affected by vibration, rather than vibration change criteria. Further information is provided in Volume 1, Introduction and methodology, Section 8.

Environmental baseline

Existing baseline

3.7.18 The area around Preston Station is characterised by residential properties and industrial buildings in a predominantly urban setting.

3.7.19 The sound environment is generally dominated by local and distant road and rail traffic, including the West Coast Main Line (WCML) serving Preston Station. Local neighbourhood sources of sound from commercial facilities and nature (such as bird song and trees) also contribute to sound levels in the area.

3.7.20 There are several main roads within the Preston Station area, including the A59 Ring Way (between Bow Lane and the A6 London Road), the A59 New Hall Lane and the A59 Preston

[34] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

[35] Day, evening and night-time periods are defined in Volume 5: Appendix SV-001-00000, Sound, noise and vibration methodology, assumptions and assessment.

[36] Further information is available in the Volume 5: Appendix SV-001-00000, *Sound, noise and vibration methodology, assumptions and assessment report* and the Volume 5: Appendix CT-001-0001, *Environmental Impact Assessment Scope and Methodology Report*.

New Road. Other main roads that contribute to the sound environment are the A5072 Strand Road, the A6 London Road, Corporation Street, Fishergate and Fishergate Hill.

3.7.21 Sound levels close to these main transportation routes are high during the daytime and are generally lower at night-time. Sound levels decrease with increasing distance from the main transportation routes.

3.7.22 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for the Preston Station area in Volume 5: Appendix SV-001-OR001.

Future baseline

3.7.23 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth, which may be as a result of local or national trends or due to specific committed developments. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads. On higher speed roads, tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

3.7.24 Committed developments involving sound or vibration sensitive uses within the relevant study area have been included within the assessment and are reported for the Preston Station area in Volume 5: Appendix SV-001-OR001[37]. Where applicable, noise or vibration significant effects on these committed developments are discussed in this section and are summarised in Table 4.

Table 4: Committed developments relevant to sound, noise and vibration

Map book reference[38] (SNV Assessment location ref.)	Planning reference	Description	How this is considered in the assessment
PSTN/012 (618375, 618376)	LCC/2016/0085	Location: 8, East Cliff, Preston, PR1 3JE Change of use/conversion/extension of the former Park Hotel building from offices (Class B1) back to a hotel (Class C1) to include a new build single-storey pavilion building and demolition of the existing JDO office building and its replacement with a six storey office building/extension to the hotel. Change of use/conversion/part demolition and rebuild of no. 8 East Cliff from offices (Class B1) to health spa (Class D1). Alongside remodelling of existing car parking and landscaping works (Article 16 Consultation)	Informing future baseline (construction)

[37] Volume 5: Appendix CT-004-OR001 provides details of all of the developments assumed to be implemented.

[38] Volume 5, Planning Data/Committed Development Map Book, Map CT13-801.

Construction

3.7.25 The assessment of noise from construction activities assumes a future construction baseline year of 2026, which represents the period immediately prior to the start of the construction period. As a reasonable worst-case, it has been assumed that no change in baseline sound levels will occur between the existing baseline year of 2018 and the future construction baseline year of 2026.

3.7.26 The peak level of construction traffic activity for the Proposed Scheme is expected to occur in 2028.

Effects arising during construction

Avoidance and mitigation measures

3.7.27 The assessment assumes the implementation of the principles and management processes set out in the noise and vibration section of the draft CoCP, Section 13, which are:

- best practicable means (BPM) as defined by the Control of Pollution Act 1974 (CoPA)[39] and Environmental Protection Act 1990 (EPA)[40], which will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties and other sensitive receptors (including local businesses and quiet areas designated by the local authority);
- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example, the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on-site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings;
  - screening: for example, local screening of equipment or perimeter hoarding or the use of temporary stockpiles; and
  - where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary rehousing will be offered at qualifying properties.
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of the CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise and vibration, including control of working hours, and provide a further assessment of construction noise and vibration, including confirmation of noise insulation/temporary rehousing provision;

[39] *Control of Pollution Act 1974.* Her Majesty's Stationery Office, London. Available online at: https://www.legislation.gov.uk/ukpga/1974/40/contents.

[40] *Environmental Protection Act 1990*. Her Majesty's Stationery Office, London. Available online at: https://www.legislation.gov.uk/ukpga/1990/43/contents.

- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to, and be reviewed by, the nominated undertaker and made available to the local authorities; and
- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the nominated undertaker as required to ensure compliance.

3.7.28 Noise insulation will be offered for qualifying buildings as defined in the draft CoCP. Noise insulation or, where appropriate, temporary rehousing will avoid residents being significantly affected by levels of construction noise inside their dwellings. The assessment reported in this section provides an estimate of the buildings that are likely to qualify for noise insulation. The assessment shows that none are predicted to qualify for noise insulation or temporary rehousing.

3.7.29 Qualification for noise insulation and, where appropriate, temporary rehousing will be confirmed, as part of seeking prior consent from the local authority under Section 61 of the CoPA. Qualifying buildings will be identified, as required in the draft CoCP, so that noise insulation can be installed, or where appropriate any temporary rehousing provided, before the start of the works predicted to exceed noise insulation or temporary rehousing criteria.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

3.7.30 Taking account of the avoidance and mitigation measures set out in the previous paragraphs, no residential properties are forecast to experience noise above the eligibility criteria for noise insulation, as defined in the HS2 noise insulation and temporary rehousing policy[41]. Further information on the assessment of effects on individual dwellings is presented in Volume 5: Appendix SV-001-OR001.

Residential receptors: direct effects – communities

3.7.31 The avoidance and mitigation measures to be implemented during construction will reduce airborne construction noise adverse effects on receptors and communities. Residual temporary noise or vibration effects are identified later in this section.

3.7.32 In locations with lower existing sound levels[42], construction noise effects are likely to be caused by changes to noise levels outside dwellings relative to existing sound levels. These may be considered by the local community as an effect on the acoustic character of the area and hence be perceived as a change in the quality of life for that community. These effects

[41] High Speed Two Ltd (2022), *Phase 2b Western Leg Information Paper E13: Control of construction noise and vibration.*

[42] Further information is presented in Volume 5: Appendix SV-001-00000.

are considered to be significant when assessed on a community basis taking account of the local context.

3.7.33 The temporary adverse effects on the residential areas identified in Table 5, including shared open areas, are considered to be significant on a community basis.

Table 5: Direct adverse construction effects on residential communities and shared open areas that are considered to be significant on a community basis

Significant effect number[43]	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact[44]
PSTN-C-C1	Construction noise	Daytime	Approximately 20 dwellings in the vicinity of Fishergate Court and Christian Road, Preston	Platform refurbishment, footbridge construction and platform extension construction. The typical and highest monthly noise levels are approximately 65dB and 75dB	Up to one year and two months

Residential receptors: indirect effects

3.7.34 Construction traffic is not likely to cause adverse noise effects on any occupants of dwellings in the Preston Station area.

Non-residential receptors: direct effects

3.7.35 The assessment has identified the following non-residential receptors where the predicted airborne noise levels exceed both the relevant impact screening criteria and the noise change criterion (typically a change of greater than 3dB[45] compared with the existing baseline sound level). These locations are identified in the Preston Station area, as shown in Volume 5, Sound, noise and vibration Map Book, Map Series SV-03:

- 4 Butler Street (offices), Preston (assessment location ref.: 618368);
- Lancashire County Council (offices), Preston (assessment location ref.: 618372);
- former Park Hotel Complex, East Cliff, Preston (assessment location ref.: 618375);
- 5 Butler Street (offices), Preston (assessment Location ref.: 618380);
- various commercial offices, 1, 3, 5, 6 and 7 Fishergate Court, Fishergate, Preston (assessment location ref.: 618381); and

[43] Further information is presented in Volume 5: Appendix SV-001-OR001.

[44] At the closest properties in the community.

[45] The exception is where the use and sensitivity of the receptor or land use is very sensitive to noise and have been included in the detailed assessment where there is a change less than 3dB. Further information can be found in Volume 5: Appendix SV-001-OR001.

- three serviced apartments, 2 Fishergate Court, Fishergate, Preston (assessment location ref. 618381).

3.7.36 At each of the non-residential receptors identified above an assessment has been undertaken to determine if this impact would result in a significant effect, using the significance criteria set out in Annex A of Volume 5: Appendix SV-001-00000.

3.7.37 Number 4 Butler Street is a two-storey brick office building occupied by Cordant People recruitment agents. The facade facing the station is fitted with double-glazing which is openable for natural ventilation. The highest predicted daytime monthly construction noise level is 7dB(A) above the screening criterion for offices defined in the SMR for a period of two months. The typical monthly daytime construction noise does not exceed the screening criteria defined in the SMR. It is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by PSTN-C-N1 in Table 7, Volume 5: Appendix SV-001-OR001). This temporary adverse effect may take the form of activity disturbance to users of the office.

3.7.38 The Lancashire County Council building comprises council offices and is a four-storey brick building. The facade facing the station is fitted with sash windows which are opened to provide natural ventilation. The opening times for the public are 09:00 to 17:00 Monday to Friday. Noise levels have been predicted at the facade. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for office use[46] for a period of one year and two months. The highest predicted daytime monthly construction noise level is 11dB(A) above the screening criteria defined in the SMR. The typical predicted monthly daytime construction noise level is 8dB(A) above the screening criteria defined in the SMR. It is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by PSTN-C-N2 in Table 7, Volume 5: Appendix SV-001-OR001). This temporary adverse effect may take the form of activity disturbance to users of the office.

3.7.39 The former Park Hotel Complex site at East Cliff, which has been operating as an office for several years, is to be redeveloped back to a hotel before the commencement of the Proposed Scheme. The existing building, which is being retained as part of the redevelopment, is a four-storey brick building. Noise levels have been predicted at the facade. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for hotel use for a period of two months[47]. The highest predicted daytime monthly construction noise level is 8dB(A) above the screening criteria defined in the SMR. The typical predicted monthly daytime construction noise level is 6dB(A) above the screening criteria defined in the SMR. It is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by PSTN-C-N3 in Table 7, Volume 5: Appendix SV-001-OR001). This temporary adverse effect may take the form of activity disturbance to workers and guests of the hotel.

[46] 55dB $L_{pAeq,0700-2300}$ (free-field) during the day, which is equivalent to 58dB $L_{pAeq,0700-2300}$ (facade).

[47] 50dB $L_{pAeq,0700-2300}$ (free-field) during the day, which is equivalent to 53dB $L_{pAeq,0700-2300}$ (façade).

3.7.40 Number 5 Butler Street is an office building containing offices for Northwood Estate Agents. Number 5 Butler Street is accessed from Butler Street, approximately 30m to the east of the land required for the construction of the Proposed Scheme in the Preston Station area. The building is two-storeys high, the facade is brick, and the pitched roof is tiled. All facades are assumed to comprise typical thermal glazing. The ventilation strategy for the buildings is mechanical ventilation/natural ventilation by open windows. The offices generally operate between 09:00 to 17:30 Monday to Friday, 09:30 to 12:30 Saturday and are closed on Sunday. Number 5 Butler Street has been assessed against the office criteria. Noise levels have been predicted for the facade of the building facing towards the land required for the construction of the Proposed Scheme. The highest predicted daytime monthly construction noise levels at this building are 7dB(A) above the screening criteria defined in the SMR for a period of two months. The typical monthly daytime construction noise does not exceed the screening criteria defined in the SMR. Number 5 Butler Street (offices) is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by PSTN-C-N4 in Table 7, Volume 5: Appendix SV-001-OR001). This temporary adverse effect may take the form of activity disturbance to users of the office.

3.7.41 Numbers 1 - 7 Fishergate Court, Fishergate, Preston, comprises commercial offices, serviced apartments and residential block over three to four-storeys high depending upon aspect. The commercial accommodation comprises offices for several businesses within numbers 1, 3, 5, 6 and 7 at ground, first and second floor levels. Number 2 Fishergate Court comprises five serviced apartments also on the ground, first and second floor levels. The south and east facades of three apartments face the Proposed Scheme whereas two apartments face towards Fishergate and away from the Proposed Scheme. Fishergate Court is accessed from Fishergate, approximately 30m to the west of the land required for the construction of the Proposed Scheme. All facades are brick and are assumed to comprise typical thermal glazing. The ventilation strategy for the buildings is natural ventilation by open windows. The offices generally operate between 09:00 to 17:30 Monday to Friday and are closed Saturday and Sunday. Noise levels have been predicted for the facade of the development facing towards the land required for the construction of the Proposed Scheme. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for office and hotel use for a period of one year and two months. The highest and typical predicted daytime monthly construction noise levels at this building are 14dB(A) and 12dB(A) respectively above the screening criteria defined in the SMR for office use[46]. The highest and typical predicted daytime monthly construction noise levels at the south and east facades of this building are 19dB(A) and 17dB(A) respectively above the screening criteria defined in the SMR for hotel use[47]. Fishergate Court (offices and 3 of the 4 serviced apartments with windows in the south and/or east facades) is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by PSTN-C-N5 in Table 7, Volume 5: Appendix SV-001-OR001). This temporary adverse may take the form of activity disturbance to users of the offices and activity disturbance to guests of the serviced apartments.

Other mitigation measures

3.7.42 No other mitigation measures are proposed in this area.

Non-residential receptors: indirect effects

3.7.43 Construction traffic is not likely to cause adverse noise effects on any non-residential receptors in the Preston Station area.

Summary of likely residual significant effects

3.7.44 The proposed avoidance and mitigation measures will reduce noise inside all individual dwellings from the construction activities such that residents will not be significantly affected[48].

3.7.45 The measures will also reduce the construction noise effects on acoustic character in the majority of residential communities. Despite these measures, the effects on the acoustic character in the local residential community area of Fishergate Court and Christian Road, Preston are considered likely to be significant.

3.7.46 Noise from specific construction activities has been identified as resulting in significant residual temporary effects on the non-residential buildings at:

- Number 4 Butler Street, Preston;
- Lancashire County Council, Preston;
- former Park Hotel Complex, East Cliff, Preston;
- Number 5 Butler Street, Preston; and
- Numbers 1, 2, 3, 5, 6 and 7 Fishergate Court, Fishergate, Preston.

3.7.47 HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptor(s), its/their use and the benefit of the measures.

Cumulative effects

3.7.48 This assessment has considered the potential cumulative construction noise effects of the Proposed Scheme and other committed developments[49]. It is not anticipated that there will be any significant cumulative noise effects during construction of the Proposed Scheme.

[48] Refer to Volume 5: Appendix SV-001-00000.

[49] Refer to Volume 5: Appendix CT-004-OR001, Planning data.

Effects arising from operation

Assessment of impacts and effects

3.7.49 Given the nature of the works, direct and indirect operational effects are not anticipated and therefore no assessment is presented for the works associated with the Proposed Scheme in this section of the report. The potential permanent indirect operational effects associated with the works at Preston Station are considered further in Section 5.3 of this report.

Monitoring

3.7.50 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

3.7.51 Operational noise and vibration monitoring will be carried out at different times during the lifetime of the Proposed Scheme at a combination of carefully selected monitoring locations. The locations will be: adjacent or attached to moving vehicles; at fixed positions or in the vicinity of individual assets; and locations within the surrounding areas and communities alongside the railway corridor.

3.7.52 The expected noise and vibration performance of the Proposed Scheme, operational noise and vibration measurement data, associated asset information, description of corrective actions, results of measured performance compared to expected conditions, and monitoring reports will be shared with the relevant local authorities at appropriate intervals.

3.8 Traffic and transport

Introduction

3.8.1 This section considers the likely impacts on all forms of transport and the consequential potential significant effects on transport users arising from the construction and operation of the Proposed Scheme within the Preston Station area. The effects on traffic and transport are assessed quantitatively, based on existing baseline traffic conditions and future scenarios.

3.8.2 Engagement with Highways England, Lancashire County Council (LaCC), and Preston City Council (PCC) has been undertaken. An important focus of this engagement has been to obtain relevant baseline information and discuss transport survey requirements and assessment methodology.

3.8.3 A detailed report on traffic and transport impacts within the Preston Station area is contained in Volume 5: Appendix TR-001-000, Transport Assessment Part 4.

3.8.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book.

3.8.5 Maps showing traffic and transport significant effects during construction (Map Series TR-03) and operation (Map Series TR-04) and construction routes to compounds (Map Series TR-08) can be found in Volume 5, Traffic and transport Map Book.

3.8.6 In addition, further traffic and transport data are set out in Background Information and Data (BID)[50], (see BID TR-004-00001: Transport Assessment policy and data).

3.8.7 The Proposed Scheme is described in Section 3.1.

Scope, assumptions and limitations

3.8.8 The scope, assumptions and limitations for the traffic and transport assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report[51].

3.8.9 This section considers the potential significant effects on transport users arising from the construction of the Proposed Scheme within the Preston Station area and improvements, alterations and adaptations to the existing Preston Station, both during construction and operation. The potential effects arising from changes in demand at Preston Station during operation are considered in Section 5.3 of this report.

3.8.10 The peak level of construction traffic activity for off-route works is expected to be 2028 and the opening year to be 2038. The forecasts used in the assessment have been produced prior to the development of a full understanding of the likely impact of COVID-19 on economic growth and travel behaviour. The full impact of COVID-19 is not yet known but is considered likely to result in lower travel demand in the medium term than the forecasts used in the assessment for background traffic and rail, including HS2.

3.8.11 The study area for traffic and transport includes the area immediately surrounding Preston Station (see Volume 4, Off-route effects Map Book, Map CT-05-802). The study area for traffic and transport also includes all strategic and local roads potentially affected by the Proposed Scheme including the strategic routes: the M6 (including junction 31) and the M65 (including junction 1a).

3.8.12 For all roads, the baseline forecast traffic flows for the future years of assessment have been derived using the Department for Transport's (DfT) traffic forecasting tool, Trip End Model Presentation Program (TEMPro). The assessment covers the average weekday morning (08:00 – 09:00) and evening (17:00 – 18:00) peak hours.

3.8.13 Forecast future year traffic flows in this off-route assessment, with and without the Proposed Scheme, have been based on an approach that does not take account of wider effects such as redistribution and reassignment of traffic. This is consistent with the

[50] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[51] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report.*

assessment of other phases of HS2. It is not considered that these wider changes will affect the conclusion of the assessment.

3.8.14 Where the effects vary through the construction programme the most significant effects are reported. Where there are both adverse and beneficial effects at different times, the most adverse and most beneficial are both reported.

Environmental baseline

Existing baseline

3.8.15 Existing conditions in the study area have been determined through site visits, traffic and transport surveys, liaison with Highways England and LaCC (including provision of information on public transport, public rights of way (PRoW), accident[52] data) and desktop analysis. Further information on the traffic and transport environmental baseline at Preston Station can be found in Section 5.3.

Surveys

3.8.16 Traffic surveys, comprising junction turning counts, manual classified counts, queue length surveys and automatic traffic counts, were undertaken in October 2017, November 2017, March 2019 and July 2019. Car park and drop off surveys were undertaken in March 2017. Assessment of the data indicates that the weekday peak hours in the area are generally 08:00 – 09:00 and 17:00 – 18:00 which correspond to the Proposed Scheme assessment hours.

3.8.17 No PRoW will be impacted by the Proposed Scheme, therefore no PRoW surveys were undertaken within the Preston Station area.

Strategic and local highway network

3.8.18 The strategic routes that pass through the area and that the construction routes will connect to are the M6 (including junction 31) and the M65 (including junction 1a). The strategic road network in and around the Preston Station area is generally busy during peak hours and delays can be experienced.

3.8.19 The local roads include (ordered by road class from south to north):

- A582 Flensburg Way/Penwortham Way/Farington Road/Golden Way;
- A6 London Road;
- A59 Liverpool Road/Leyland Road/Guild Way/New Hall Lane/Preston New Road/Stanley Street/Ring Way; and
- A5072 Strand Road.

[52] The term accident in this report refers to injury related collisions reported to/recorded by the police. These data, known as STATS19, relate only to personal injury accidents on public roads that are reported to the police, and subsequently recorded, using the STATS19 accident reporting form.

3.8.20 The local road network in this area generally operates well, although some localised delays can be experienced, particularly at peak times.

3.8.21 Relevant accident data for the road network subject to assessment have been obtained from the DfT[53]. Data for the three-year period from July 2016 to June 2019 have been assessed and any identified clusters (i.e. where there are nine or more accidents in the three-year period) have been examined.

3.8.22 Ten accident clusters were identified within the Preston Station area that have the potential to be impacted by construction or operation of the Proposed Scheme:

- M6 Junction 29/A6 Church Road/A6 Lostock Lane – in total there were 15 accidents, of which three were classified as serious;
- M61 Junction 9/M65 Junction 2 – in total there were 29 accidents, of which four were classified as serious;
- A6 London Way/A6 Lostock Lane/A6 South Ribble Way/A582 Lostock Lane – in total there were nine accidents, of which one was classified as serious;
- A582 Penwortham Way/A582 Golden Way/Pope Lane – in total there were nine accidents, of which two were classified as serious and seven were classified as slight;
- M6 Junction 31/A59 Preston New Road – in total there were 11 accidents, all of which were classified as slight;
- A6 Stanley Street (between A59 New Hall Lane and A6063 Ribbleton Lane) – in total there were 10 accidents, of which two were classified as serious an eight were classified as slight;
- A6 Ring Way/A6063 Church Street/Church Street – in total there were nine accidents, of which four were classified as serious and five were classified as slight;
- A6 North Road (between St Georges Road and Frank Street) – in total there were 12 accidents, of which one was classified as serious and 11 were classified as slight;
- A59 New Hall Lane/St Mary's Street – in total there were nine accidents, of which three were classified as serious and six were classified as slight; and
- A583 Water Lane/A5072 Strand Road – in total there were nine accidents, of which one was classified as serious and eight were classified as slight.

Parking and loading

3.8.23 There is off-street car parking within the Preston Station area that may be impacted by the Proposed Scheme, including:

- an off-street parking area associated with Network Rail offices at North Union House, accessed via Christian Road and located adjacent to the west of Preston Station;

[53] Department for Transport (2021), *STATS19 Road Safety Data July 2016 - June 2019*. Available online at: https://www.gov.uk/government/collections/road-accidents-and-safety-statistics.

- the surface-level Station Car Park accessed via Butler Street and located immediately adjacent to the south-east of Preston Station; and
- the existing Network Rail Technical Support Depot accessed via Butler Street and located immediately adjacent to the south-east of Preston Station.

3.8.24 Servicing of the existing Preston Station area takes place from an entrance on Butler Street. The Network Rail Preston Delivery Unit and the Royal Mail Preston Central Delivery Office are accessed from Christian Road.

Public transport network

3.8.25 The Preston Station area is well served by public transport with access to rail (via Preston Station) and many bus routes operating in the area. Together, they provide excellent connectivity with the city centre and the surrounding areas.

3.8.26 Bus routes 2, 2A, 3, 12, 43, 74, 75, 77, 77A, 89, 111, 119, 433, 656, S2 and X2 all operate along Fishergate, and are served by four bus stops close to the entrance to Preston Station.

3.8.27 Where bus routes and stops are expected to be affected by either the construction or operation of the Proposed Scheme, these are referred to in the relevant assessment sections.

3.8.28 National and local rail services are accessible via Preston Station. Preston Station provides access to national services to on the WCML. Local services on the Cumbrian Coast Line and the Newcastle Line are also accessed from Preston Station.

Non-motorised users

3.8.29 There are footways alongside most roads in the Preston Station area, together with several PRoW, including public footpaths and bridleways adjacent to the River Ribble, 350m to the south of Preston Station. However, it is not expected that any PRoW will be affected by the Proposed Scheme.

3.8.30 National Routes 6, 55, 62 and 622 (part of the National Cycle Network) pass through the Preston Station area.

Waterways and canals

3.8.31 There are no navigable waterways within the Preston Station area potentially affected by the Proposed Scheme. Consequently, this topic is not considered further in this assessment.

Air transport

3.8.32 There is no relevant air transport within the Preston Station area. Consequently, this topic is not considered further in this assessment.

Future baseline

3.8.33 The future baseline traffic volumes have been calculated for the future year of 2028. This has been used to support the assessment of construction of the Proposed Scheme, reflecting the assumed construction peak (2028). Future baseline traffic volumes have also been calculated for the future year of 2046 to support the assessment of the operation of the Proposed Scheme, in relation to changes in passenger demand. Growth factors have been checked to ensure that committed developments are appropriately reflected in the growth forecasts. The assumptions underlying committed development and transport schemes for each assessment year have been discussed with LaCC and are considered to be appropriately reflected in the traffic forecasts.

3.8.34 It is difficult to forecast how public transport services may change in the future; therefore, unless information on future services is available, it has been assumed that public transport services for the future years of assessment will be the same as those currently operating. Similarly, pedestrian and cycle demand and facilities and parking are assumed to remain unchanged from the base year. For the Preston Station area, there are no known substantial committed changes to the transport network, parking, pedestrian and cycling facilities.

Construction

3.8.35 Construction of the Proposed Scheme is expected to commence in 2026 with construction activity continuing to 2028. Construction activities have been assessed against 2028 baseline traffic flows, irrespective of when they occur during the construction period.

3.8.36 The year 2028 is the common future baseline year for off-route works and the impact of individual or overlapping activities are considered against this single year.

3.8.37 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 7.3% by 2028 compared to a baseline year of 2019.

Operation

3.8.38 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 28% by 2046 compared to a baseline year of 2017.

Effects arising during construction

Avoidance and mitigation measures

3.8.39 The following measures are currently proposed to avoid or reduce effects on transport users:

- traffic management measures will be implemented to limit any disruption;
- heavy goods vehicles (HGV) will be routed, insofar as reasonably practicable, along the strategic and/or primary road network;

- the use of the local road network will, insofar as reasonably practicable, be limited to use for site set-up, access for surveys and ongoing servicing (including refuse collection and general deliveries to compounds) during construction;
- highway measures including junction improvements will be provided, as required, to manage the safe passing of construction vehicles on construction HGV routes;
- on-site welfare facilities will be provided, which will reduce highway trips by site workers; and
- delivery of materials and equipment will be made via the conventional rail network, insofar as reasonably practicable.

3.8.40 Section 14 of the draft Code of Construction Practice (CoCP)[54] includes measures that aim to reduce the adverse impacts and effects on local communities and maintain public access. This includes the impacts of deliveries of construction materials and equipment.

3.8.41 The measures in the draft CoCP include controls on vehicle types, hours of site operation and routes for HGVs to reduce the impact of road-based construction traffic. In order to achieve this, general and site-specific traffic management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads and PRoW affected by the Proposed Scheme.

3.8.42 The draft CoCP includes the requirement to develop local traffic management plans in consultation with the highway and traffic authorities and the emergency services. These will consider the local traffic management strategy including consideration of sensitive receptors, such that adverse impacts will be reduced, insofar as reasonably practicable.

3.8.43 Specific measures include core site operating hours of 08:00 to 18:00 on weekdays and 08:00 to 13:00 on Saturdays with site staff and workers generally arriving before the morning peak hour and departing after the evening peak hour. Activities such as major concrete pours may involve extended working hours for reasons of engineering practicability. However, workers will mostly arrive and depart outside of the peak traffic hours.

3.8.44 The number of private car trips to and from the construction compounds (both workforce and visitors) will be reduced by encouraging alternative sustainable modes of transport or vehicle sharing. This will be supported by an overarching framework travel plan that will require construction workforce travel plans to be produced that will include a range of potential measures to mitigate the impacts of workers' traffic and transport movements associated with construction of the Proposed Scheme. The travel plans will promote the use of sustainable transport modes as appropriate to the location and types of trip. They will include measures such as: provision of information on and promotion of public transport services; provision of good cycle and pedestrian facilities; liaison with public transport operators; promotion of car sharing; and the appointment of a travel plan coordinator to ensure suitable measures are in place and are effective.

[54] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

3.8.45 Where works potentially affect Network Rail assets, disruption to travelling passengers and freight movements will be reduced insofar as reasonably practicable. This includes measures such as:

- programming the construction works to coincide with the possessions that are required and planned by Network Rail for the general maintenance of their railway;
- planning the required construction works so that they can be undertaken in short overnight stages so that passenger services are not disrupted; and
- programming longer closures at the weekend and on bank holidays to reduce, insofar as reasonably practicable the number of passengers affected.

Assessment of impacts and effects

Temporary effects

3.8.46 The following section considers the impacts on traffic and transport and the likely consequential significant effects resulting from the construction of the Proposed Scheme.

Key construction transport issues

3.8.47 The traffic and transport impacts during the construction period within the Preston Station area will include:

- construction vehicle movements to and from the construction compounds;
- possessions and blockades on the conventional rail network;
- impacts on the existing Preston Station due to construction work which could affect users of the station and users of the adjacent highway network; and
- loss of some station and Network Rail office and compound car parking.

3.8.48 Construction vehicle movements required to construct the Proposed Scheme will include the delivery of plant and materials, movement of excavated materials and site worker trips.

3.8.49 Details of the construction compounds are provided in Section 3.1. Table 6 provides details of the compound set up date and the duration of active use. The duration of active use excludes any period where there are no substantial workforce trips or movement of materials to and from the compound.

3.8.50 Table 6 also provides a summary of this along with the HGV and car/light goods vehicle (LGV) access trips at each compound in the peak month of activity and during the busy period. For each compound, the peak month of activity is the month within which HGV traffic is at its highest for that compound. The busy period is the period during which HGV traffic serving that compound will be greater than 50% of the HGV traffic in the peak month. Two-way trips refer to the total number of vehicle movements in both directions (e.g. with 200 westbound vehicles and 100 eastbound, there would be 300 two-way trips). The average daily combined two-way vehicle trips for the busy period is the lower end of the range shown in Table 6 and

the average daily combined two-way vehicle trips for the peak month is the upper end of the range shown. The estimated duration of busy period is also provided.

Table 6: Typical vehicle trip generation for construction compounds within the Preston Station area

Compound type	Compound name	Indicative start/set up date (years/ quarters)	Estimated duration of active use (years/ months)	Average daily combined two–way car/LGV trips during busy period and within peak month of activity	Average daily combined two–way HGV trips during busy period and within peak month of activity	Estimated duration of busy period (years/ months)
Main	Parcel Sidings main compound	2026 Q3	2 years	59-78	10-12	10
Satellite	Butler Street satellite compound	2026 Q3	2 years	63-108	11-16	19

3.8.51 Table 7 summarises the access routes to and from each compound to the main road network. For some compounds, Table 7 includes multiple construction routes. This is either because the construction route varies depending on the origin/destination of the trip or because the construction route varies over time to account for changes to the highway network through the construction period.

3.8.52 The average daily combined two-way vehicle trips reported in Table 6 represent the total number of vehicle movements to and from each compound during the busy period and in the peak month of activity on all of the available construction routes combined. Where multiple routes are shown in Table 7, the split of construction traffic between the available routes will vary based on the point in the construction programme and the origin/destination of the traffic.

Table 7: Construction routes for construction compounds within the Preston Station area

Compound name(s)	Access routes to/from compound(s) to main road network
Parcel Sidings main compound	Christian Road, Fishergate, Fishergate Hill and the A59 Liverpool Road
Butler Street satellite compound	Butler Street, Fishergate, Fishergate Hill and the A59 Liverpool Road

3.8.53 Information on the indicative construction programme is provided in Section 3.1 and the construction methodology is summarised in Volume 1, Introduction and methodology, Section 6. This illustrates how the phasing of activities at different compounds will generally be staggered and that construction activities at individual compounds may not occur over the whole duration presented in Table 6.

3.8.54 The assessment of the effects of construction of the Proposed Scheme on the highway network in the Preston Station area is based on the highest volume of construction traffic on each construction route during the construction period. Where construction routes will serve

more than one construction compound, the assessment is based on the highest combined volume of construction traffic on each section of each route during the construction period.

Highway network

Strategic and local highway network

3.8.55 The primary HGV access routes for construction vehicles will be the strategic and/or primary road network with the use of the local road network limited, insofar as reasonably practicable. The construction routes will also provide access to compounds. In this area, the main construction routes will be:

- A582 Flensburg Way/Penwortham Way/Farington Road/Golden Way;
- A6 London Road;
- A59 Liverpool Road/Leyland Road/Guild Way/New Hall Lane/Preston New Road/Stanley Street/Ring Way;
- A5072 Strand Road;
- Corporation Street;
- Fishergate Hill;
- Fishergate;
- Bow Lane;
- Butler Street; and
- Christian Road.

3.8.56 Due to the limited scope of the works, the number of two-way vehicle movements to compounds is expected to be low during the local road network peak periods. The daily maximum flow is predicted to be 90 two-way vehicle movements to the Parcel Sidings main compound and 124 two-way vehicle movements to the Butler Street satellite compound. The majority of these vehicle movements will be worker trips or LGV movements and are expected to occur outside the local road network peak periods. The daily maximum HGV flow is expected to be 12 two-way movements to the Parcel Sidings main compound and 16 two-way vehicle movements to the Butler Street satellite compound. This level of change in traffic levels will not result in adverse significant effects in relation to traffic severance for non-motorised users or in relation to traffic delays and congestion.

Accidents and safety

3.8.57 There will be no significant effects on accidents and safety as there will be no substantial increases in traffic during construction.

Parking and loading

3.8.58 The Proposed Scheme will have impacts on parking in the local area. This is likely to result in the following effects, which are significant:

- the temporary loss of approximately 66 private off-street parking spaces associated with the existing Network Rail offices at North Union House, accessed via Christian Road. This construction activity will last for two years resulting in a major adverse effect;
- the temporary loss of approximately 28 off-street parking spaces associated with existing Station Car Park, accessed via Butler Street. This construction activity will last for two years resulting in a moderate adverse effect; and
- the temporary loss of approximately 57 off-street parking spaces within the Network Rail Technical Support Depot, accessed via Butler Street. This construction activity will last for two years resulting in a major adverse effect.

3.8.59 HS2 Ltd will work with the businesses affected to identify opportunities where reasonably practicable to mitigate effects on parking.

Public transport network

3.8.60 Construction of the Proposed Scheme will not result in any significant effects upon the operation of existing bus services or stops.

3.8.61 There will be interfaces with the existing rail network in this area, in particular on the operation of the WCML and branch lines from Colne, Ormskirk and Blackpool, and on the passengers and rail freight services using these lines.

3.8.62 The construction of the Proposed Scheme is expected to require a number of rail possessions and blockades over a period of up to two years in this area. This will include one possession of up to 27 hours and 18 possessions of up to 52 hours on specific lines. In addition, there will be one blockade, of up to nine days in duration, comprising a full station closure. The possessions and blockades will be required to enable the construction of Proposed Scheme elements including the following: extension, widening and reinstatement of platforms, the provision of a new footbridge link and track alignment/renewal works.

3.8.63 Disruption to rail users will be reduced by limiting possessions, where reasonably practicable, to existing maintenance periods. Possessions and blockades will affect users of the WCML and branch lines from Colne, Ormskirk and Blackpool and will be managed through a combination of measures, which could include rail service diversions and replacement bus services, which will reduce the disruption to the travelling public.

3.8.64 Users of Preston Station will be affected by construction of the Proposed Scheme. During major possessions and blockades alternative transport options will be provided. Nonetheless, while individually these possessions are not considered significant, the possessions will occur intermittently over a period of one year and nine months and their cumulative impact is considered to have a major adverse effect, which is significant.

3.8.65 Since users of the WCML will be affected by possessions and blockades in the Preston Station area and other community areas the effects of these are reported in Volume 3, Route-wide effects, Section 14.

3.8.66 HS2 Ltd will work with Network Rail and the train operating companies and freight operating companies to ensure that any need for additional possessions can be reduced with good planning and communication (including appropriate advance notice).

3.8.67 Passenger routes within Preston Station between platforms, concourse and surface connections and interchange will be affected throughout the construction period. The proposed phasing indicates that interchange routes and surface connections can be maintained with increases in travel distance of less than 100m. The proposed works to Preston Station are not forecast to result in significant effects to public transport users at the station as a result of changes to passenger routes.

Non-motorised users

3.8.68 The construction works associated with the Proposed Scheme will not require the temporary closure or diversion/realignment of any PRoW or roads in the vicinity of the Proposed Scheme.

Permanent effects

3.8.69 Any permanent effects of construction are considered in the assessment of operation for traffic and transport.

Other mitigation measures

3.8.70 The implementation of the measures in the draft CoCP, including travel plans, will help mitigate the transport-related effects during construction of the Proposed Scheme.

3.8.71 No further traffic and transport mitigation measures during construction of the Proposed Scheme are considered appropriate.

Summary of likely residual significant effects

3.8.72 Due to the limited scope of the works, the increases in traffic associated with the construction of the Proposed Scheme will not result in any significant effects on vehicle users or non-motorised users.

3.8.73 The construction of the Proposed Scheme will result in the temporary loss of 66 parking spaces at the existing Network Rail offices at North Union House (major adverse effect), the temporary loss of 28 spaces at the Station Car Park (moderate adverse effect) and the temporary loss of 57 parking spaces within the Network Rail Technical Support Depot (major adverse effect).

3.8.74 During the construction period, the cumulative impact of railway possessions is considered to have a major adverse significant effect on the operation of the branch lines from Colne, Ormskirk and Blackpool, and on the passengers and rail freight services using these lines. Since the WCML will be affected by possessions and blockades in the Preston Station area and other community areas the effects of these are reported in Volume 3, Route-wide effects, Section 14.

Cumulative effects

3.8.75 The assessment includes the cumulative effects of planned and committed development during construction by taking this into account within the background traffic growth.

3.8.76 The assessment also takes into account Proposed Scheme construction traffic and transport impacts of works to construct the Proposed Scheme being undertaken in neighbouring community areas.

Effects arising from operation

3.8.77 This section presents the likely significant environmental effects arising from the operation of the Proposed Scheme within the Preston Station area and improvements, alterations and adaptations to the existing Preston Station. The significant effects associated with changes in passenger numbers are considered in Section 5.3.

Avoidance and mitigation measures

3.8.78 The design of the works at Preston Station will avoid or reduce impacts on transport users through the following measures:

- enhanced facilities to accommodate HS2 services; and
- extension, widening and reinstatement of platforms, the provision of a new footbridge link, refurbishment and reopening of the luggage and passenger subways to provide lift and stair access for the public to platform 0, maintaining capacity for non-HS2 users.

Assessment of impacts and effects

3.8.79 The following section considers the impacts on traffic and transport as a result of the improvements, alterations and adaptations to the existing Preston Station and the consequential effects resulting from the operational phase of the Proposed Scheme.

Key operation transport issues

3.8.80 The main impacts of the operation of the Proposed Scheme at Preston Station can be summarised as the modification of the station to accommodate HS2 trains, which will provide direct and fast access and improved journey times from Preston to the Midlands and the south of England.

3.8.81 The Proposed Scheme will also result in changes in passenger demand and will require additional staff to operate from Preston Station, including drivers, managers, cleaners and customer services. The likely impacts arising from the associated changes in vehicle movements and parking demand at Preston Station, as a result of the operation of the Proposed Scheme, are considered in Section 5.

Public transport network

3.8.82 The design of the Proposed Scheme and its operation will result in substantially improved journey times between Preston Station, the Midlands and the south of England, as detailed in Volume 1, Introduction and methodology. This is a major beneficial effect, which is significant.

3.8.83 The proposed changes to the station layout are not expected to have a significant effect on existing station users as a result of any changes to physical linkage for the next stage of their journey or access to public transport. Access to all platforms will be provided via an existing lift, connecting with the existing subway to maintain step-free access for persons with reduced mobility.

Other mitigation measures

3.8.84 No further traffic and transport mitigation measures are considered appropriate for the operation of the Proposed Scheme based on the outcome of the assessment.

Summary of likely residual significant effects

3.8.85 The Proposed Scheme will generate significant major beneficial effects for rail passengers as a result of the introduction of HS2 services at Preston Station, including improved journey times between Preston Station, the Midlands and the south of England and released capacity on the network easing pressure on other passenger rail services.

4 Carlisle Station

4.1 Overview of the area and description of the Proposed Scheme

Overview of the area

General

4.1.1 The Proposed Scheme in the Carlisle Station area will comprise works to the existing Carlisle Station. As described below, these works will include the extension of two existing platforms, infilling of a platform, and construction of a new platform, in order to allow HS2 trains to call at the station. The Proposed Scheme at Carlisle Station will be on land within Network Rail ownership.

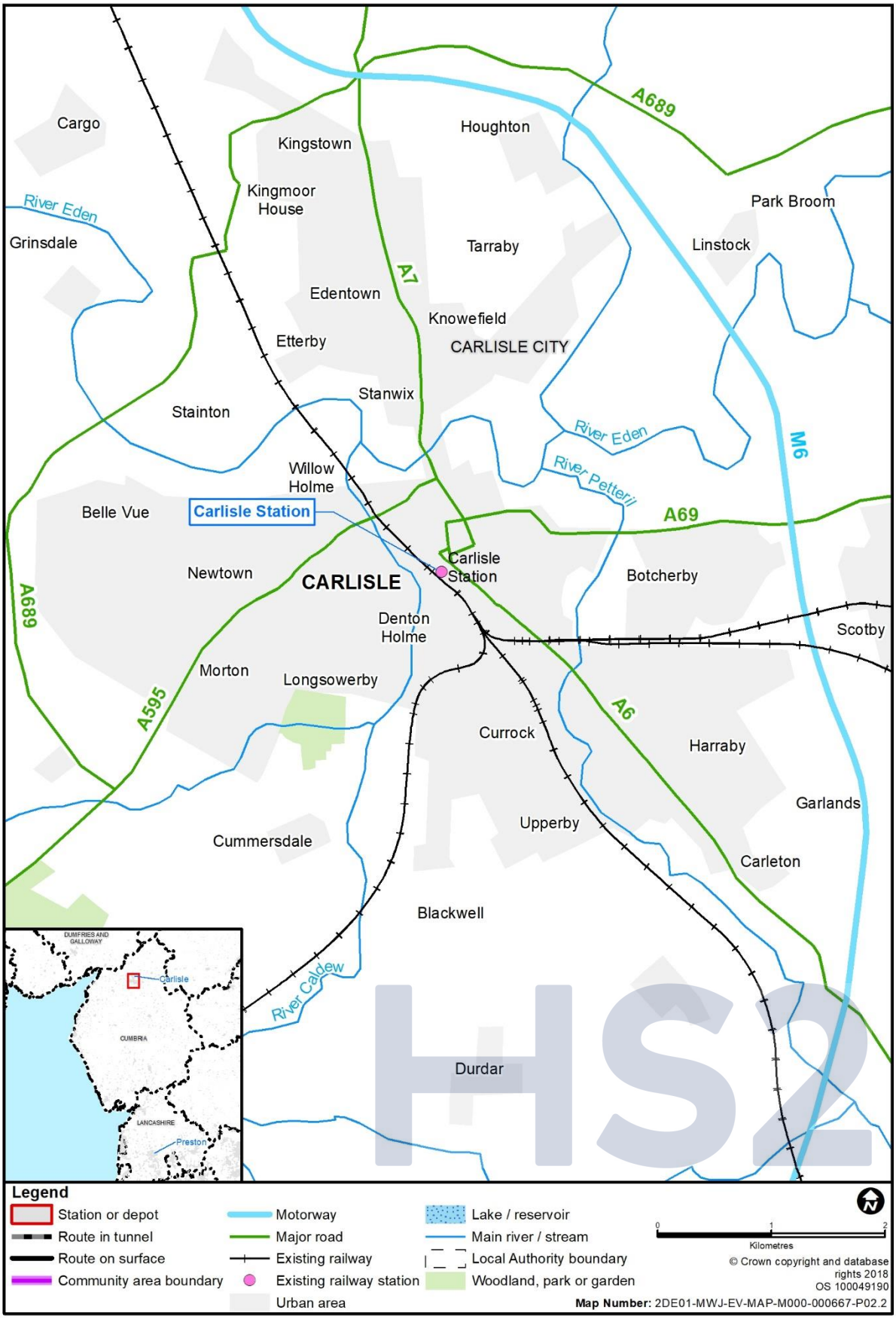
4.1.2 Carlisle Station is situated within Carlisle city centre, to the south of Victoria Viaduct and English Street, west of the A6 Botchergate and east of James Street. Carlisle City Council (CaCC) is the local authority for the Carlisle Station area which also lies within the county administered by Cumbria County Council (CuCC). Figure 7 shows the location of the Proposed Scheme.

Settlement, land use and topography

4.1.3 The Carlisle Station area is predominantly urban in character. The main land uses surrounding Carlisle Station are industrial, business, retail and leisure, with limited residential properties within the vicinity of the station. Carlisle Station is a Grade II* listed building, which also includes a Grade II listed wall within the main station complex. There are also a number of listed buildings within the vicinity, in addition to several scheduled monuments to the north-west of the station. These include a Roman and medieval town area bounded by Heads Lane West Wall and Blackfriars Street; and a town wall section on West Walls.

4.1.4 The topography around Carlisle Station is generally flat at approximately 20m above Ordnance Datum (AOD).

Figure 7: Carlisle Station area context map



Key transport infrastructure

4.1.5 Carlisle Station is a railway station on the West Coast Main Line (WCML), providing services to London, Birmingham, Manchester, Glasgow, and Edinburgh. The station is also served by local trains to Leeds, Barrow-in-Furness, Newcastle, Morpeth and Dumfries.

4.1.6 The M6 is the only strategic route that passes through the area. Other principal highways within this area include the A6 Roman Road/Carleton Road/London Road/Botchergate, the A69 Rotary Way/Warwick Road/Victoria Place, the A7 Spencer Street/Georgian Way/Victoria Place/Lowther Street and the A595 Bridge Street/Castle Way.

4.1.7 Carlisle Bus Station provides local, regional and national bus services connecting the city centre to all key suburban areas of the city and surrounding areas. Carlisle Bus Station lies approximately 325m to the north of Carlisle Station.

4.1.8 There are several public rights of way (PRoW) in the vicinity of Carlisle Station including public footpaths in Carlisle city centre and adjacent to the River Caldew and River Eden. In addition, there are two national cycle routes, route 7 and 72, which are part of the National Cycle Network. Route 7 is located, at its closest point, approximately 275m to the west of Carlisle Station adjacent to the River Caldew. Route 72 is located approximately 800m to the north of Carlisle Station.

Socio-economic profile

4.1.9 The agriculture, forestry and fishing sector accounts for the largest share of businesses within the CaCC area (14%), followed by the construction (10%) and financial and insurance (10%) sectors[55].

4.1.10 According to the Annual Population Survey (2020)[56], the employment rate (the proportion of residents aged 16 – 64 in employment) within the CaCC area was 77% (51,100 people). The unemployment rate within the CaCC area was 5%.

4.1.11 The same survey indicates that 35% of residents aged 16-64 in the CaCC area were qualified to National Vocational Qualification Level 4 (NVQ4) and above, while 6% had no qualifications.

Notable community facilities

4.1.12 The city of Carlisle contains a range of shops, restaurants, services and community facilities including medical and educational facilities and places of worship.

[55] Office for National Statistics (2020), *UK Business Counts – local units by industry and employment size band 2020.* Available online at: http://www.nomisweb.co.uk/datasets/idbrlu.

[56] Office for National Statistics (2020), *Annual Population Survey, NOMIS.* Available online at: http://www.nomisweb.co.uk/datasets/apsnew. This number includes the jobs held by residents of CaCC irrespective of where they work.

4.1.13 The community facilities within the Carlisle Station area include several doctors' surgeries, dentists, pharmacists, a non-profit social enterprise Creative Wellbeing UK located in Carlisle Station and one hospital, Cumberland Infirmary, located approximately 1km north-west of Carlisle Station. There are also several schools within the Carlisle Station area including Norman Street Primary School, Brook Street Primary School, Robert Ferguson Primary School and Richard Rose and Trinity School Sixth Form. Carlisle College and the University of Cumbria and Library Services for Schools are also located within the Carlisle Station area.

4.1.14 Places of worship and religious education within the Carlisle Station area include Carlisle Cathedral, Hebron Evangelical Church, St George's United Reformed Church, Carlisle City Church, Carlisle Vineyard Church, St Cuthbert's Church and Carlisle Christian Fellowship.

Recreation, leisure and open space

4.1.15 There are a number of promoted routes (routes which are promoted routes in their own right as a recreational resource) in the Carlisle Station area. These include The Hadrian's Wall Path National Trail, located approximately 1km north-east of Carlisle Station and The Cumbrian Way, a trail through the Lake District, ending in Carlisle at the River Caldew, located approximately 250m west of Carlisle Station. Although the Carlisle Station area is a predominantly urban area, there are a number of open spaces including Bitts Park Tennis and Recreation Area, Brunton Park, Tullie House Garden and Melbourne Park.

4.1.16 Recreation and leisure facilities in the Carlisle Station area include Guildhall Museum, Carlisle Library, Carlisle Castle, Urban Adventure, Trinity Leisure Centre, The Pools Swimming and Health Centre, University of Cumbria Sports Centre, Carlisle Canoe Club, Swifts, Aztec Soft Play, Carlisle Subscription Bowling Club, Cumbria Indoor Bowls Club and Little Kickers.

Policy and planning context

4.1.17 Volume 1, Introduction and methodology provides an overview of the policy case for HS2.

Planning framework

4.1.18 Relevant development plan documents and other planning policies have been considered in relation to environmental topics, as part of considering the Proposed Scheme in the local context. Development plan documents and other planning policies relevant to the Carlisle Station area are listed in Volume 5: Appendix CT-004-OR002, Planning data.

4.1.19 These have been considered and referred to where appropriate in the assessments reported in Section 4.3 of this report.

Committed development

4.1.20 Committed developments are defined as developments with planning permission and sites allocated for development, or safeguarded for minerals in adopted development plans, on or close to the land required for the Proposed Scheme. Volume 1, Introduction and

methodology, Section 7 sets out the approach to identifying and considering committed developments in the assessment. The committed developments relevant to the assessment of the Proposed Scheme in the Carlisle Station area are listed in Volume 5: Appendix CT-004-OR002, Planning data and are shown in Volume 5, Planning Data/Committed Development Map Book, Map CT-13-802.

4.1.21 These have been considered to determine whether they would result in a material change to the future baseline or have the potential to give rise to cumulative effects for each environmental topic. The committed developments considered in the assessment for the Carlisle Station area are reported in the relevant topic sections of this report.

Description of the Proposed Scheme

4.1.22 The following section describes the main features of the Proposed Scheme in the Carlisle Station area. Further general information on typical permanent features is provided in Volume 1, Introduction and methodology, Section 5. Similarly, a general description of the approach to mitigation is explained in Volume 1, Introduction and methodology, Section 9.

4.1.23 Land required for the operation of the Proposed Scheme is shown on Volume 4, Off-route effects Map Book, Map Series CT-06. Land required for the operation of the Proposed Scheme is within the existing operational railway boundary and within Network Rail's operational land. Land required for construction of the Proposed Scheme is shown on Volume 4, Off-route effects Map Book, Map Series CT-05.

4.1.24 The Proposed Scheme in the Carlisle Station area will comprise works to the existing Carlisle Station. These works will include the extension of two existing platforms, infilling of a platform, and construction of a new platform, in order to accommodate HS2 services to call at the station. The Proposed Scheme at Carlisle Station will be on land within Network Rail ownership.

4.1.25 This section describes the key features and works associated with the Proposed Scheme. All dimensions in this section are approximate.

4.1.26 Key features of the Proposed Scheme are also shown on Volume 4, Off-route effects Map Book, Map CT-06-803 and include:

- platform 2 infill at the southern end of the station;
- a new platform (platform 0) will be provided to accommodate the Cumbrian Coast Line services displaced from bay platform 2. The new platform 0 will be 125m in length, parallel to platform 1 on the south-western side of the station, with a canopy over the platform;
- provision of a new passenger lift to provide access to platform 0 via a subway created in an existing undercroft;
- extension of platform 1 by 15m on southern side of the station and 12m on the northern side of the station to accommodate HS2 services;

- a section of the existing canopy above platform 1 will be removed to accommodate a new footbridge between platform 1 and the new platform 0. The new footbridge will provide access for passengers to the new platform 0;
- extension of platform 3 by 23m on the southern side of the station to accommodate HS2 services; and
- the existing station canopy over platforms 1 and 3 will be extended to protect the increased length of platforms.

4.1.27 Users of all the platforms, including the new platform 0, will use the existing station entrances, ticket hall and concourse.

4.1.28 In addition, there will be modifications to the track layout, signalling, overhead line equipment and other railway systems within the Carlisle Station area to facilitate the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-803, A5 to I5).

Demolitions

4.1.29 No demolitions will be required to construct the permanent features or to enable the construction works for the Proposed Scheme in the Carlisle Station area.

Construction of the Proposed Scheme

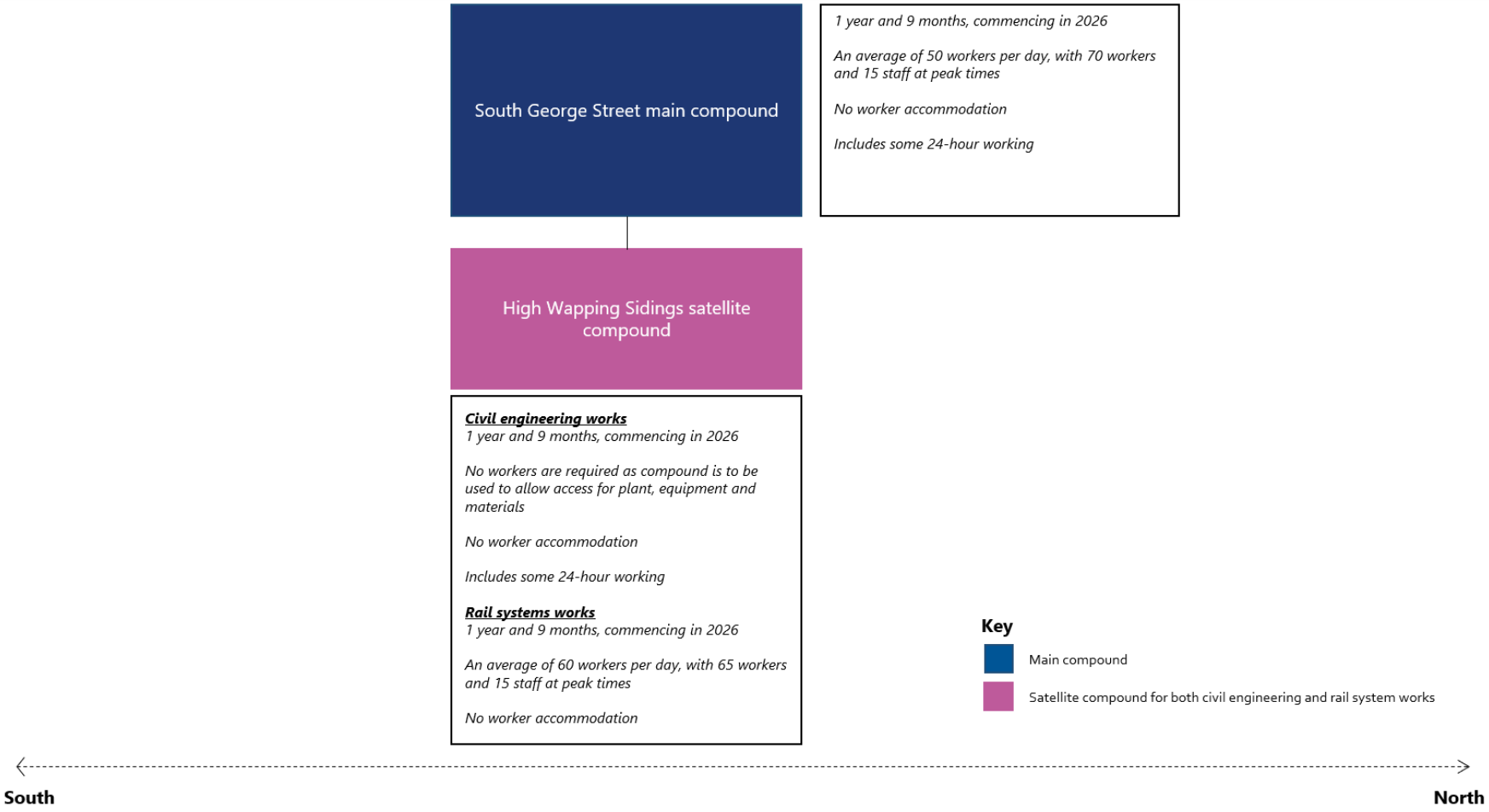
Introduction

4.1.30 Volume 1, Introduction and methodology, Section 6 provides details of the typical construction techniques which will be used to construct the Proposed Scheme. Section 2 of this report describes the typical approach to the key construction activities needed to build the Proposed Scheme. This section provides information on the construction activities that are envisaged to be needed to build the Proposed Scheme in the Carlisle Station area, which provide the basis for the construction assessment.

General overview of the construction compounds

4.1.31 This section provides a summary of the works to be managed from the construction compounds in the Carlisle Station area, as illustrated in Figure 8. All dates and durations of activities and numbers of workers are indicative. All compounds will undertake initial site set-up works, and at the end of its use, finalisation works including site reinstatement, landscaping and planting (as necessary).

Figure 8: Construction compounds for civil engineering and railway system works



South George Street main compound

4.1.32 This compound (shown on Volume 4, Off-route effects Map Book, Map CT-05-803, F5 to G5) will be used to manage civil engineering works. It will:

- provide main compound support to High Wapping Sidings satellite compound as illustrated in Figure 8; and
- be accessed via James Street off Victoria Viaduct (see Volume 4, Off-route effects Map Book, Map CT-05-803, G5).

4.1.33 No demolitions will be required as a result of the works to be managed from this compound.

4.1.34 The compound will be used to manage the following works to the station:

- the removal of existing track and infill of bay platform 2 at the southern end of the station which will take three months to complete;
- the extension of platforms 1 and 3 at the southern end of the station which will take six months to complete;
- the extension of platform 1 at the northern end of the station which will take three months to complete;
- the construction of the new platform (platform 0) which will take one year to complete;
- the construction of Carlisle Station new passenger lift to provide access to platform 0 via a subway, created in an existing undercroft, which will take nine months to complete; and
- the construction of Carlisle Station new footbridge between platform 1 and new platform 0 which will take six months to complete.

High Wapping Sidings satellite compound

4.1.35 This compound (shown on Volume 4, Off-route effects Map Book, Map CT-05-803, D5 to E5) will be used to manage civil engineering and railway systems works. It will:

- be used to manage rail system works for a period of one year, followed by both civil engineering and railway systems works for a period of six months, followed by rail system works only for a period of three months; and
- be accessed via Crown Street off Currock Street and Crown Street off Botchergate.

4.1.36 No demolitions will be required as a result of the works to be managed from this compound.

4.1.37 The compound will be used to manage the following works to the existing track and platforms:

- the removal of existing track and infill of bay platform 2 at the southern end of the station (Platform 2 Infill South in Figure 9 below) which will take three months to complete;

- the extension of platforms 1 and 3 at the southern end of the station which will take six months to complete; and
- the extension of platform 1 at the northern end of the station which will take three months to complete.

4.1.38 Key railway systems installation works to be managed from this compound include the modification to the track layout, signalling, overhead line equipment and other railway systems which will take one year and six months to complete.

Construction programme

4.1.39 A construction programme illustrating indicative periods for each of the core construction activities described above is provided in Figure 9.

Figure 9: Indicative construction programme for Carlisle Station between 2026 and 2028

Carlisle Station	2026 Quarters				2027 Quarters				2028 Quarters			
Construction Activity	1	2	3	4	1	2	3	4	1	2	3	4
South George Street Main Compound												
Site preparation and set-up												
Platform 0												
Carlisle Station new subway												
Carlisle Station new lift												
Carlisle Station new footbridge												
Platform 1 and 3 extension (south)												
Platform 2 infill (south)												
Platform 1 extension (north)												
Site reinstatement												
High Wapping Satellite Compound												
Site preparation and set-up												
Platform 1 and 3 extension (south)												
Platform 2 infill (south)												
Platform 1 extension (north)												
Rail systems installation												
Site reinstatement												

Operation of the Proposed Scheme

Introduction

4.1.40 This section describes the operational characteristics of the Proposed Scheme in the Carlisle Station area. Volume 1, Introduction and methodology, Section 4 describes the envisaged operational characteristics of the Proposed Scheme as a whole, including Phase One, Phase 2a and Phase 2b.

HS2 services

4.1.41 It is anticipated that there will be up to three HS2 trains per hour arriving from the south (two from London Euston and one from Birmingham) and up to five trains from the north (Glasgow and Edinburgh). The London services will be formed of two 200m trains coupled together that will split into separate 200m trains that will service Edinburgh and Glasgow, twice an hour. The Birmingham service will alternate between Glasgow and Edinburgh on an hourly basis.

4.1.42 Services are expected to operate between 05:00 and midnight from Monday to Saturday and between 08:00 and midnight on Sunday.

Maintenance

4.1.43 Volume 1, Introduction and methodology, Section 4 describes the maintenance regime for the Proposed Scheme as a whole.

4.1.44 Railway infrastructure maintenance in this location will be undertaken by Network Rail as per the current provisions.

4.1.45 Train stabling, light maintenance and internal cleaning of trains will be undertaken at Annandale depot which is described in Section 6 of this report.

4.2 Stakeholder engagement

Introduction

4.2.1 This section summarises the approach to stakeholder engagement and consultation for the Proposed Scheme in the Carlisle Station area.

Consultation on the working draft ES

4.2.2 As set out in Volume 1, Introduction and methodology, Section 3, two parallel consultations were undertaken by HS2 Ltd in 2018: a consultation on the working draft ES and a consultation on the working draft EQIA. These consultations related to the full Phase 2b Scheme (including both Eastern Leg and Western Leg). As part of the process of consultation, stakeholders were invited to comment on the full Phase 2b scheme and the working draft ES and working draft EQIA Report. Documents were made available on the gov.uk website.

4.2.3 Information events were held at locations along the route of the Proposed Scheme as part of the consultation, including at Carlisle Station (November 2018).

4.2.4 A total of 37,899 responses were received through the consultation on the working draft ES for the Proposed Scheme as a whole. These responses were analysed. The themes and issues relevant to the Carlisle Station area included commentary on:

- the impacts that changes to the existing Carlisle Station would have on current users of the station;
- train service specifications and how HS2 would affect existing local and regional services, including concerns regarding reduction in existing services and in particular those that serve the key tourist destination of the Lake District; and
- the benefits to Carlisle and the wider region.

Consultation on design refinements

4.2.5 There were no design refinements consulted on in the Carlisle Station area, although the Proposed Scheme's design and mitigation has continued to evolve, taking into account ongoing assessment and stakeholder feedback. Further detail on the approach to consultation and route-wide engagement is outlined in Volume 1, Introduction and methodology, Section 3.

Engagement and consultation with stakeholder groups

4.2.6 Direct engagement has been offered to and undertaken with city, borough and county councils within the Carlisle Station area. The purpose of this engagement was to collate local baseline information and knowledge to inform the design and assessment, identify and understand local issues and concerns, provide access to wider stakeholders and communities and provide a mechanism for ongoing dialogue and discussion on the assessment and design development

4.2.7 Engagement has also focused on the technical areas that inform the assessment, including the historic environment, sound, noise and vibration and traffic and transport, amongst others. Briefings were offered to specialist and technical stakeholders across the Proposed Scheme during the period of consultation on the working draft ES and as part of the route-wide update between October and November 2020 (using online channels) to provide information on the evolving design and assessment of the Proposed Scheme in their respective areas.

4.2.8 As part of the route-wide update between October and November 2020 and an additional route-wide update between June and July 2021, targeted engagement was also offered to those stakeholders who have land, property or business operations directly affected by the construction and operation of the Proposed Scheme to meet (using online channels where necessary) with technical experts to gain better understanding of emerging design and share their thoughts on how this might affect them. Members of local communities and other interested parties were also invited to engage on issues pertinent to the development of the Proposed Scheme design and its assessment.

4.2.9 HS2 Ltd has offered to engage with all relevant MPs during the development of the Proposed Scheme in order to discuss key issues and concerns.

4.2.10 Table 8 summarises key engagement undertaken with all stakeholders relating to the Carlisle Station area to date, including local authorities, statutory bodies, specialist organisations, and community stakeholders. This includes a summary of the focus of the engagement and how this has informed the design and assessment of the Proposed Scheme.

Table 8: Engagement to date with stakeholders

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Local authority	Cumbria County Council	Series of meetings to discuss the Proposed Scheme, provide updates on consultation activities and understand potential impacts on the local community. Key discussion points included impacts: • on users of the station and on local traffic and transport links during construction; • effects on the existing local and regional train services; and • economic regeneration opportunities. HS2 Ltd has also participated in Carlisle Station Board meetings which have focused on local authority plans for refurbishment of the station and improvements to the passenger environment.	Feedback used to improve understanding of baseline conditions, potential impacts and proposed mitigation concerns and opportunities for the Carlisle Station area.
Local authority	Carlisle City Council	Series of meetings to discuss the Proposed Scheme, provide updates on consultation activities and understand potential impacts on the local community. Key discussion points included impacts on: • users of the station and on local traffic and transport links during construction; • effects on the existing local and regional train services; and • economic regeneration opportunities.	Feedback used to improve understanding of baseline conditions, potential impacts and proposed mitigation concerns and opportunities for the Carlisle Station area.
Statutory and national	Environment Agency	Land quality, water and flood risk issues.	Informed land quality, water resources, surface water flood risk and Water Framework Directive methodology. Improved understanding of baseline conditions for the Proposed Scheme and the proposed mitigation.
Statutory and national	Highways England	Strategic road network, traffic and transport issues.	Informed the assessment of road network capacity and identification of proposed future works by Highways England.

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Statutory and national	Historic England	Nationally designated heritage assets and the heritage assessment methodology.	Informed methodology for assessing setting and impacts on historic landscape at national and regional level. Also informed identification and assessment methodology of designated and non-designated heritage assets.
Statutory and national	Natural England	Ecology, agricultural, land quality and landscape and visual related issues.	Provided information regarding the natural environment on a route-wide basis. Informed methodological approach and detailed local conditions and factors to be taken into consideration in the assessment and opportunities for mitigation. Following this engagement, ecological, agricultural, land quality and landscape and visual impacts were scoped out of the assessment for the Carlisle Station area.
Statutory and national	Network Rail	Rail infrastructure.	Informed route-wide considerations around rail infrastructure network and factors to be considered in the design and assessment of the Proposed Scheme, including the changes required to Carlisle Station to accommodate HS2.
Local authority technical meetings	Cumbria County Council and Carlisle City Council	Meeting to discuss the ecology and biodiversity assessment including the mitigation strategy.	Information used to improve understanding of local conditions and factors to inform the design of the Proposed Scheme and assessment.

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Local authority technical meetings	Cumbria County Council and Carlisle City Council	Meetings with technical leads to discuss the historic environment assessment.	Information used to improve understanding of local conditions and factors to inform the design of the Proposed Scheme and assessment.
Local authority technical meetings	Cumbria County Council and Carlisle City Council	Meetings to discuss landscape and visual impact impacts including viewpoint locations.	Information used to improve understanding of local conditions and factors to inform the design of the Proposed Scheme and assessment.
Local authority technical meetings	Cumbria County Council and Carlisle City Council	Meeting to discuss the sound, noise and vibration and air quality assessment including proposed mitigation.	Information used to improve understanding of local conditions and factors to inform scheme design and assessment relating to sound, noise and vibration.
Local authority technical meetings	Cumbria County Council and Carlisle City Council	Meetings to provide information on the Proposed Scheme and obtain relevant baseline information and discuss transport survey requirements and assessment methodology relating to traffic and transport.	Improved understanding of local traffic flows, highways operations and future proposals and informed the emerging design and assessment of the Proposed Scheme.

4.3 Environmental assessment

Introduction

4.3.1 This section reports the environmental assessment undertaken for the Proposed Scheme in the Carlisle Station area.

Scope, assumptions and limitations

4.3.2 The following environmental topics have been identified as relevant to the assessment of Carlisle Station: air quality; historic environment; socio-economics; sound, noise and vibration; and traffic and transport. An assessment of the potential likely significant effects for these topics is reported below. All other topics were scoped out on the basis that the Proposed Scheme will not give rise to the potential for likely significant effects.

4.4 Air quality

Introduction

4.4.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction of the Proposed Scheme within the Carlisle Station area. Oxides of nitrogen (NOx) including nitrogen dioxide (NO_2), fine particulate matter (particles of size less than 2.5µm and 10µm in diameter, referred to as $PM_{2.5}$ and PM_{10}, respectively) and dust have been considered in the assessment. Emissions of all or some of these air pollutants are likely to arise from construction activities, demolition and site preparation works. Emissions will also arise from road traffic during construction of the Proposed Scheme.

4.4.2 Engagement with Carlisle City Council (CaCC) has been undertaken. The purpose of this engagement has been to obtain relevant baseline information, which includes monitoring data in this area.

4.4.3 Detailed reports on the air quality data and assessments for this area are contained within Volume 5: Appendix AQ-001-OR002. Additional information on air quality monitoring and traffic data used in the assessment is set out in Background Information and Data (BID), BID AQ-002-OR002[57].

4.4.4 Maps showing the location of the key environmental features and the key construction features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 4.1.

4.4.5 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

4.4.6 The scope, assumptions and limitations for the air quality assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report (SMR)[58] and Volume 5: Appendix AQ-001-OR002. No significant effects on air quality are anticipated during the operation of the Proposed Scheme. The operation of the Proposed Scheme has therefore been scoped out and is not considered in the assessment.

4.4.7 The study areas for the air quality assessment have been determined on the basis of where impacts on local air quality may occur:

- from construction activities;

[57] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[58] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

- from changes in the nature of traffic during construction; for example, increases in traffic flows during construction, or where road closures or restrictions cause diversions and heavier traffic on adjacent roads; or
- from changes to road alignment.

4.4.8 The assessment of construction dust emissions has been undertaken for sensitive receptors located up to 350m from dust generating activities. The assessment of traffic emissions has been undertaken for sensitive receptors located up to 200m from roads screened in for further assessment.

4.4.9 The assessment has incorporated HS2 Ltd's policies on vehicle emissions[59]. These include the use of Euro VI heavy goods vehicles (HGV), Euro 4 petrol and Euro 6 diesel cars and light goods vehicles (LGV) during construction of the Proposed Scheme.

4.4.10 The assessment of construction traffic impacts has used traffic data based on an estimate of the average daily flows in the peak year during the construction period. The assessment assumes vehicle emission rates and background pollutant concentrations from year 2025, as the first year of construction for the full Proposed Scheme as set out in Volume 1, Introduction and methodology. As both pollutant emissions from vehicle exhausts and background pollutant concentrations are anticipated to reduce year by year as a result of vehicle emission controls, the year 2025 represents the worst case for the construction assessment.

Environmental baseline

Existing baseline

Background air quality

4.4.11 The main sources of air pollution in the Carlisle Station area are emissions from road vehicles. The main roads within the area are the A6 Roman Road/Carleton Road/London Road/Botchergate, James Street, Victoria Viaduct, English Street, and the A7 Spencer Street/Georgian Way/Victoria Place/Lowther Street.

4.4.12 There is one industrial installation (regulated by the Environment Agency) with permits for emissions to air for NO_x and/or PM_{10}, United Biscuits (UK) Ltd. Its details are presented in BID AQ-002-OR002. The contribution of all industrial processes and other emission sources to local air quality is included within the background concentrations.

4.4.13 Estimates of background air quality have been taken from the Department for Environment, Food and Rural Affairs (Defra)[60] for the baseline year of 2018. The data are estimated for

[59] High Speed Two Ltd (2022), *Phase 2b Western Leg Information Paper E14: Air quality.*

[60] Department for Environment, Food and Rural Affairs (Defra) (2020), *Defra Background Pollutant Concentration Maps*. Available online at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018.

1km grid squares for NO_x, NO_2, PM_{10} and $PM_{2.5}$. Background concentrations were within the air quality standards for all pollutants within the Carlisle Station area.

Local monitoring data

4.4.14 There are currently 15 local authority diffusion tube sites located within 1km of the Carlisle Station area for monitoring NO_2 concentrations. These are located along the A6 London Road/Botchergate, Currock Street, Charlotte Street, Junction Street, The Crescent, Warwick Road/the A7 Lowther Street and the A595 Wigton Road/Church Street/Bridge Street/Castle Way.

4.4.15 There is also one continuous air quality monitoring site (part of Defra's Automatic Urban and Rural Monitoring Network (AURN)) within the Carlisle Station area for monitoring NO_2, PM_{10} and $PM_{2.5}$ concentrations, in a roadside location on the A595 Bridge Street.

4.4.16 Measurements of NO_2 were within the air quality standard at all but one location in 2018. At the A595 Bridge Street, annual mean NO_2 concentrations were above the air quality standard in 2018. Measurements of PM_{10} and $PM_{2.5}$ were within the air quality standard at the location monitored.

4.4.17 The monitoring data are presented in Volume 5: Appendix AQ-001-OR002 and BID AQ-002-OR002.

Air quality management areas

4.4.18 There are five air quality management areas (AQMA) within the CaCC area; the Carlisle AQMA No.2, the Carlisle AQMA No.4, the Carlisle AQMA No.5, the Carlisle AQMA No.6 and the Carlisle A7 AQMA.

4.4.19 The Carlisle AQMA No.2 covers an area encompassing Currock Street and the properties immediately to the west of it, between the junction with James Street/Water Street and Crown Street. The Carlisle AQMA No.2 was declared in January 2007. The Carlisle AQMA No.4 covers an area along the north side of the A595 Bridge Street, northbound from the junction with Shaddongate, and was declared in August 2008. The Carlisle AQMA No.5 covers an area encompassing the junction of the B5299 Dalston Road and Junction Street and was declared in August 2008. The Carlisle AQMA No.6 covers an area encompassing part of the A6 London Road and properties on either side near the junction with Blake Street, and was declared in August 2008. The Carlisle A7 AQMA covers an area encompassing the A7, between Hardwicke Circus and junction 44 of the M6, and 100m of the B6264 Brampton Road, as measured from the Stanwix Bank junction, and was declared in December 2005.

4.4.20 All AQMA have been designated for exceedances of the annual mean NO_2 standard. Details of their locations are presented in Volume 5: Appendix AQ-001-OR002.

Receptors

4.4.21 Several locations have been identified in the area as sensitive receptors, which are considered to be susceptible to changes in air quality due to their proximity to dust generating activities or traffic routes during construction of the Proposed Scheme.

4.4.22 Most of the receptors which may be affected by the Proposed Scheme are residential. Non-residential receptors include Hallmark Hotel.

4.4.23 The air quality assessment has also included receptors in ecological sites sensitive to nitrogen deposition and dust. There is one national designated ecological site of relevance to the air quality assessment identified in the Carlisle Station area, namely the River Eden which has two designations, the River Eden and Tributaries Site of Special Scientific Interest (SSSI) and the River Eden Special Area of Conservation (SAC). No other relevant local sensitive ecological sites have been identified close to the Proposed Scheme.

Future baseline

4.4.24 Volume 5: Appendix CT-004-OR002 provides details of the developments in the Carlisle Station area that are assumed to be implemented prior to construction. The potential cumulative impact from committed developments on air quality in conjunction with the effects from the construction of the Proposed Scheme has been considered as part of this assessment. The future air quality baseline is defined as the 'without the Proposed Scheme' scenario.

Construction (2025)

4.4.25 Future background pollutant concentrations have been sourced from the Defra background maps for the first year of construction in 2025, which predict NO_2, PM_{10} and $PM_{2.5}$ levels in 2025 to be lower than in the 2018 baseline and within the relevant air quality standards.

4.4.26 Committed developments that have been included as future receptors in the assessment of air quality impacts during construction of the Proposed Scheme are identified in Volume 5: Appendix AQ-001-OR002. No additional committed developments have been identified in this study area that will materially alter the baseline conditions in 2025 for air quality.

Effects arising during construction

Avoidance and mitigation measures

4.4.27 Emissions to the atmosphere will be controlled and managed during construction through the route-wide implementation of the Code of Construction Practice (CoCP). The draft CoCP[61] includes a range of mitigation measures that are accepted by the Institute of Air Quality Management (IAQM) as being suitable to reduce impacts to as low a level as is

[61] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

reasonably practicable. These measures are generally sufficient to avoid any significant effects from dust during construction.

4.4.28 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP will be implemented. These include:

- contractors being required to manage dust, air pollution, odour and exhaust emissions during construction works;
- inspection and visual monitoring, undertaken in consultation with the local authorities, to assess the effectiveness of the measures taken to control dust and air pollutant emissions;
- cleaning (including watering) of vehicle routes and designated vehicle waiting areas to suppress dust;
- the use of water spray systems on demolition sites to dampen down fugitive dust;
- keeping soil stockpiles away from sensitive receptors where reasonably practicable, also taking into account the prevailing wind direction relative to sensitive receptors;
- the use of enclosures to contain dust emitted from construction activities; and
- soil spreading, seeding and planting of completed earthworks as soon as reasonably practicable following completion of earthworks.

4.4.29 Prior to commencement of activities, there will be further detailed assessment for each worksite to determine site specific dust mitigation.

Assessment of impacts and effects

Temporary effects

4.4.30 Impacts from construction of the Proposed Scheme could arise from dust generating activities and emissions from construction traffic. As such, the assessment of construction impacts has been undertaken for dust and exposure to NO_2, PM_{10} and $PM_{2.5}$ concentrations.

Construction dust effects

4.4.31 The risks of demolition of existing structures, earthworks, construction of new structures and trackout have been assessed for their effect on dust soiling, human health[62] and ecological sites. Trackout refers to the transport of dust and dirt from the construction site(s) onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The human health effects of dust relate mainly to short-term exposure to PM_{10}.

[62] Human health effects relate mainly to short-term exposure to particles of size between 2.5µm to 10µm, measured as PM_{10}.

4.4.32 The identified risks potentially arising from construction dust within the Carlisle Station area are shown in Table 9. The risks are dependent on the magnitude of dust generating activities and the location of sensitive receptors in relation to these activities.

Table 9: Summary of risks for construction dust assessment

Activity	Dust soiling	Human health	Ecological effects
Demolition	Medium	Negligible	Not applicable
Earthworks	Not applicable	Not applicable	Not applicable
Construction	Low	Low	Not applicable
Trackout	Medium	Low	Medium

4.4.33 With the application of the established national best practice mitigation measures contained in the draft CoCP, no significant effects are anticipated from the risks associated with the dust generating activities. Further details of the assessment can be found in Volume 5: Appendix AQ-001-OR002 where the scale of dust emissions and the sensitivity of the area and receptors are fully described.

Construction traffic effects

4.4.34 Construction activity could also affect local air quality through the additional traffic generated on the highway network as a result of construction vehicles and through changes to traffic patterns arising from temporary road diversions and realignments.

4.4.35 The assessment of construction traffic emissions has been undertaken for a 'without the Proposed Scheme' scenario and a 'with the Proposed Scheme' scenario. The traffic data for each scenario includes the additional traffic from future committed developments.

4.4.36 Construction traffic data in the study area have been screened to identify roads that required further assessment, and to confirm the likely effect of the change in emissions from vehicles using those roads during construction of the Proposed Scheme. Following a review of the traffic data, no roads have been identified for further assessment in this area. Therefore, no significant effects are anticipated for air quality during construction of the Proposed Scheme.

Permanent effects

4.4.37 No permanent effects on local air quality are likely to arise during construction of the Proposed Scheme.

Other mitigation measures

4.4.38 No other mitigation measures are considered necessary in relation to air quality during construction of the Proposed Scheme in this area.

Summary of likely residual significant effects

4.4.39 The methods outlined within the draft CoCP are considered effective at reducing dust emissions, and therefore, no significant residual effects are anticipated.

Cumulative effects

4.4.40 The data used in the air quality assessment take account of predicted changes in traffic as a result of committed developments in the area, and therefore, their impacts have been included within the assessment. It is assumed that dust emissions from construction of other developments in the area will be controlled by appropriate measures as set out within their respective environmental management controls, and therefore, no cumulative effects for air quality are anticipated.

4.5 Historic environment

Introduction

4.5.1 This section of the report provides a description of baseline conditions for heritage assets and the identified impacts and likely significant effects resulting from the construction and operation of the Proposed Scheme within the Carlisle Station area. Consideration is given to the extent and value of heritage assets including archaeological and palaeoenvironmental remains, historic buildings, the built environment and historic landscape.

4.5.2 Engagement has been undertaken with Historic England, Carlisle City Council, Cumbria County Council and the Railway Heritage Trust. The purpose of this engagement has been to discuss the assessment approach, to obtain relevant baseline information and to inform the design development and assessment of the Proposed Scheme.

4.5.3 Appendices and Background Information and Data (BID) reports accompany this section of the report. These are:

- Volume 5: Appendix HE-002-OR002 – Summary gazetteer and impact assessment table;
- Volume 5 Map Book HE-01 – Heritage assets within the study area; and
- BID HE-001-OR002[63] – Historic environment baseline report (including a full gazetteer of heritage assets).

4.5.4 Heritage assets have been given a Unique gazetteer identifier (UID), for example OR002_0001. These have been allocated to all heritage assets within the gazetteer and are referenced throughout the Environmental Statement (ES), BID reports and in map books.

4.5.5 Maps showing the location of the key environmental features (Map Series CT-10), and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 4.1.

[63] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data, Historic Environment baseline and remote sensing report, BID HE-001-OR003*, Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

Scope, assumptions and limitations

4.5.6 The general scope, assumptions and limitations for the historic environment assessment are set out in full in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report [64] including the method for determining the value of a heritage asset and magnitude of impact.

4.5.7 The assessment focuses on the extent to which the Proposed Scheme will affect designated and non-designated heritage assets. The Proposed Scheme could impact heritage assets through the alteration, demolition or removal of the asset, or as a result of changes within the asset's setting, where setting contributes to the heritage value of the asset.

4.5.8 The study area for the assessment of effects on designated and non-designated heritage assets is the land required for the construction of the Proposed Scheme plus 250m. This is referred to in the remainder of this section as the 250m study area.

4.5.9 The Proposed Scheme relates to an existing railway corridor. Data for designated heritage assets within a 2km study area were considered, but given the scope of works at Citadel Station (also known as Carlisle Station), no significant effects resulting from changes within the settings of heritage assets are predicted beyond the 250m study area and the 2km study area is not included in baseline reporting or the assessment of effects. Similarly, historic landscape areas have not been assessed at the Carlisle Station area because the historic landscape character of this area (which includes the existing railway corridor and infrastructure) will be largely unchanged and therefore no significant effects are predicted in relation to historic landscape character.

4.5.10 The historic environment methodology includes the consideration of the relevant interactions with other topics, including ecology and biodiversity, landscape and visual, socio-economics, sound noise and vibration, water resources and flood risk, and in-combination climate change impacts. These interactions have been included in the assessment of baseline conditions, impacts and effects.

4.5.11 Where noise is considered, this is within the context of the way in which sound and noise currently contribute to the heritage value of the assets and is not a reference to absolute noise levels or sound, or the noise or vibration impacts on the health and quality of life of people who live in or visit the area.

4.5.12 For the purpose of this assessment, it is generally assumed that heritage assets within the land required for the construction of the Proposed Scheme will be retained. This is an exception to the general assumption that all assets will be removed, as set out in the SMR.

4.5.13 No areas were identified in the Carlisle Station area as requiring geophysical survey.

[64] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

Environmental baseline

Existing baseline

4.5.14 A full list of data sources used in establishing baseline conditions is provided in BID HE-001-OR002. In addition to the desk-based assessment, walkover and site reconnaissance and setting assessments from publicly accessible areas has been undertaken in the Carlisle Station area. This was carried out in order to review the nature, condition and setting of known heritage assets and identify previously unknown assets.

Designated assets

4.5.15 Designated heritage assets within the 250m study area are described in Volume 5: Appendix HE-002-OR002. The following designated heritage assets are located partially or wholly within the land required for the construction of the Proposed Scheme:

- the Grade II* listed Citadel Station (also known as Carlisle Station) (OR002_0079), a building of high heritage value;
- the Grade II listed Detached West Wall of Citadel Station (OR002_0173), a building of high heritage value;
- the Botchergate Conservation Area (OR002_0361) of moderate value;
- the Carlisle City Centre Conservation Area (OR002_0362) of moderate value; and
- the Settle to Carlisle Railway Conservation Area (OR002_0363) of moderate value.

4.5.16 The assets summarised below are located outside of the land required for the construction of the Proposed Scheme but are partially or wholly within the 250m study area:

- four scheduled monuments of high heritage value, including the town wall, areas of the Roman and medieval town, and the Cathedral Precinct;
- twelve Grade I listed buildings of high heritage value, including five assets associated with and including the Cathedral, Tullie House, a Tithe Barn, three assets associated with the city walls and the former Citadel Towers;
- eleven Grade II* listed buildings of high heritage value, including two churches, a bank, a former library and seven residential buildings;
- seventy-three Grade II listed buildings including six banks; a post office; an office; two shops; a shopping arcade; a warehouse; six public houses and inns; five hotels; 29 houses; 10 terrace houses; two vicarages; the Diocesan Church Centre; the Prebendal house; walls, gates and railings associated with the Cathedral and St Cuthbert Church; the Hospital wing of the County Gaol and two parts of the Gaol Wall; a Turkish baths; and two statues; all of moderate heritage value; and
- one conservation area of moderate heritage value.

Non-designated assets

4.5.17 The non-designated heritage assets summarised below lie wholly or partially within the land required for the construction of the Proposed Scheme. Only assets where a significant effect is predicted, as described in Section 9.4 and 9.5, are named below.

4.5.18 There are six assets of low heritage value wholly or partially within the land required for the construction of the Proposed Scheme. These date from the post-medieval and modern period and include three assets relating to industry and three assets relating to railway infrastructure.

4.5.19 The non-designated heritage assets summarised below lie wholly or partially within the 250m study area.

4.5.20 There are 71 non-designated assets of low heritage value within the 250m study area. These include nine buildings associated with religion; a jail; the medieval town gate; two buildings associated with health; a fountain; seven mills; three farmsteads; three buildings associated with recreation; six buildings associated with education; 20 buildings associated with industry; four breweries; nine assets relating to the railway; four sites of medieval and roman settlement; one residential building and one bridge.

Historic environment overview

4.5.21 The underlying solid geology of the Carlisle Station area includes the Helsby Sandstone Formation. Carlisle Castle, Carlisle Cathedral (OR002_0147) and the Citadel Towers (OR002_0049 and OR002_0050) are constructed, or partially constructed from this distinctive red sandstone. Citadel Station (also known as Carlisle Station) (OR002_0079) is constructed from an imported yellow, calciferous sandstone, which differs in colour to the local red sandstone.

4.5.22 Carlisle is situated on the Solway Plain (also known as the Solway Basin), which is a coastal plain in the north-west of Cumbria, stretching over the Scottish border around Gretna and Annandale. The Solway Plain is characterised by the large number of prehistoric settlement sites. The fertile soils attracted settlers to the Carlisle Station area, but archaeological evidence is sparse. After several decades of campaigning, the Roman occupation of Britain resulted in settlement at Carlisle. This began in AD 72 with the construction of the fort Luguvalium, which was occupied until the 5th century. In AD 122, Hadrian's Wall was constructed 300m north of Luguvalium, by the River Eden. This led to the construction of a second fort at Stanwix (1km north-east of Luguvalium fort). A civilian settlement grew around Luguvalium and would have become a busy trade centre, utilising the local rivers to transport goods.

4.5.23 In the early medieval period, after the collapse of Roman rule in Britain, the Carlisle area fell under the influence of the Kingdom of Northumbria until the 9th century. In the early 10th century, the area was part of the Kingdom of Strathclyde. Documentary evidence is poor for the early medieval period and the Domesday Survey does not cover Northumbria. Place-name evidence shows a concentration of names with the 'by' element, suggesting

Scandinavian settlement. This is evident in place names within the vicinity of Carlisle, such as Botcherby, Rickerby and Aglionby.

4.5.24 Carlisle became an established town in the medieval period due to its strategic location on the Scottish border. The Priory of St Mary was established in the 12th century, which later became the Cathedral, after the priory was dissolved in 1540. The Cathedral Precinct (OR002_0006) includes several listed buildings that formed part of the medieval core of the town. The Citadel was another prominent feature of medieval Carlisle, located on English Street and comprising the former Crown Court adjoining offices and gate arch (OR002_0049) and the Nisi Prius Courthouse (OR002_0050). The Citadel was a medieval fortress, converted to a county jail in 1611, then modified by 1810, by Thomas Telford and Sir Robert Smirke into a Nisi Prius Court and County Court. The two distinct oval towers dominated the southern entrance to the city and housed the civil and criminal courts. Trade within Carlisle flourished into the post-medieval period and the town hall (just outside of the study area) was constructed in 1668, as a place where people would have gathered and traded goods. Carlisle grew in the 19th century due to the cotton industry and the construction of railways from the 1830s, which facilitated the growth of the city.

4.5.25 Citadel Station (also known as Carlisle Station) (OR002_0079) was constructed in 1847 on behalf of a joint station committee. The building, by Sir William Tite, is among the most important early major railway stations in Britain, due to its location near the border with Scotland. Citadel Station's proximity to Scotland was key in linking Scottish cities to the English rail network. The building, and island buildings, were constructed in a Tudor style, which complements the similar Gothic Tudor style of the Citadel Towers. The main station buildings, comprising the travel centre, booking office and shop, are on the north side of the tracks. There are two undercrofts beneath the platforms which serviced the station as a butcher's store, buffet room, garages and staff accommodation. The building is constructed from calciferous sandstone ashlar with greenslate roof. The main facade is of two storeys with numerous bays in a long continuous row of differing roof levels. The central entrance is of five bays with a pointed arch. Between the entrance and offices is a clock tower which is octagonal on a square base. The single-storey former waiting and refreshment rooms have a series of facing gabled projections with various mullioned and canted bay windows.

4.5.26 The operating companies using the station at the time of construction included the Caledonian Railway, London and North Western Railway, the North Eastern Railway, the North British Railway and the Maryport and Carlisle Railway. These companies used Carlisle Station as a terminus, each with its own locomotive sheds. The sheds were located at West Walls, Upperby, London Road and Currock. Citadel Station was one of several stations in the city, but by 1851 it had become the major station. The Settle to Carlisle Railway Conservation Area (OR002_0363) includes the railway line from the south-east up to Citadel Station through Carlisle. This was constructed by the Midland Railway between 1869-76 as an alternative route to the London and North Western Railway line, which is now the West Coast Main Line. The railway runs through the Yorkshire Dales National Park and North Pennines area of outstanding natural beauty before it terminates at Citadel Station. It is a conservation area throughout.

4.5.27 Citadel Station has undergone several fundamental alterations since construction, reflecting the changing operational requirements of the railway. By the mid-1860s Citadel Station was very congested, with seven rail companies travelling over eight different routes. In 1873, in order to address congestion issues, permission was granted for the introduction of 12 new railway lines in Carlisle. This included new railway lines into Citadel Station for London and North Western Railway, and Maryport and Carlisle Railway, and separate railway lines for the goods trains.

4.5.28 Citadel Station previously functioned as a single long platform for all trains, however the station was extended in 1879-80. A new island structure was added to the station which provided extra platforms, all to be placed under a six-acre glass roof that extended to the Grade II listed detached west wall (OR002_0173). Engineers Blyth and Cunningham of Edinburgh designed an iron and glass roof with screens at each end that featured ornate wooden glazing bars in a Gothic style. Although separately listed, Citadel Station and the Grade II listed Detached West Wall have group value as the wall was once attached to the station as part of a canopy over the outer platforms. The canopy was removed in 1957-58 and the wall is now separated (see below).

4.5.29 At the start of the 20th century and despite the changes to the station in 1873 the railway was running at its busiest. Carlisle had a large proportion of workers engaged in railway operation. The number of workers resulted in the development of housing, particularly in the centre of Carlisle. The Railways Act of 1921 introduced an amalgamation scheme which reduced the number of companies operating in Carlisle from seven to two. The amalgamation of the companies resulted in a drastic reduction of railway employment within the city.

4.5.30 By the second half of the 20th century, the importance of the railway industry to the local economy began to decline. This was due to a combination of amalgamation and closure of railway lines, development of the road system and decline in use of the railways for goods traffic. Neglect, during and after World War II, led to the roof structure becoming dilapidated and dangerous. In 1957-58 the decision was taken to reduce the area of the roof and repair what remained. This reduction removed the original Gothic style end screens. Further roof renovations occurred in 1994-95 and most recently in 2016. The railway lines on the south-western side are now uncovered.

Future baseline

Construction (2025)

4.5.31 Volume 5: Appendix CT-004-OR002 provides details of the developments within the Carlisle Station area that are assumed to have been implemented by 2025.

4.5.32 No committed developments have been identified within this study area that will materially alter the baseline conditions in 2025 for historic environment.

Operation (2038)

4.5.33 Volume 5: Appendix CT-004-OR002 provides details of the developments within the Carlisle Station area that are assumed to have been implemented by 2038.

4.5.34 No committed developments have been identified within this study area that will materially alter the baseline conditions in 2038 for historic environment.

Effects arising during construction

Avoidance and mitigation measures

4.5.35 The design of the Proposed Scheme has sought to avoid adverse effects on heritage assets within the land required for construction insofar as reasonably practicable.

4.5.36 Section 8 of the draft Code of Construction Practice (CoCP[65]) sets out the measures that will be adopted, insofar as reasonably practicable, to control effects on heritage assets. These include:

- management measures that will be implemented for heritage assets that are to be retained within the land required for the construction of the Proposed Scheme;
- route-wide principles, standards and techniques for works affecting heritage assets; and
- a programme of historic environment investigation and recording (including archaeology and historic buildings) to be undertaken prior to, or during construction works affecting the heritage assets.

Assessment of impacts and effects

4.5.37 Impacts on all heritage assets described above have been assessed and are set out in the Impact Assessment Table (Volume 5: Appendix HE-002-OR002). Only impacts on heritage assets resulting in significant effects are described in the assessment set out below.

Temporary effects

4.5.38 The temporary construction works, such as excavations and earthworks for construction compounds, storage areas, and diversions of existing roads and services, have the potential to affect heritage assets during the construction period. Heritage assets could be affected as a result of changes within the assets' setting, where setting contributes to the heritage value of the asset. The duration of the activities giving rise to the temporary effect described below are set out in the indicative construction programme in Section 4.1.

4.5.39 No significant effects are expected to occur as a result of temporary impacts on designated or non-designated heritage assets due to changes that affect the contribution made by setting to the asset's heritage value.

[65] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

Permanent effects

4.5.40 Permanent construction phase effects can occur either as a result of physical impacts on heritage assets within the land required for the construction of the Proposed Scheme, or through changes to the setting of heritage assets that affect the contribution made by setting to the asset's heritage value.

4.5.41 The following significant effects will occur as a result of permanent physical impacts on heritage assets within the land required for the construction of the Proposed Scheme.

4.5.42 Citadel Station (also known as Carlisle Station) (OR002_0079) is a Grade II* listed building of high heritage value. It is located within the land required for the construction of the Proposed Scheme, which comprises alterations to the station building and track layout. The heritage value of the asset comes from its historic interest as it is one of the most important early major railway stations in Britain. The station is particularly important in the development of rail travel in Britain because it connected England and Scotland. The station derives architectural interest from the main facade of the entrance, offices and clock tower onto Court Square Brow which is built of sandstone in the Tudor style. Inside the station, the glazed roof, central footbridge, and two-storey island buildings on platforms 1 and 3 form an important architectural element of the listing. The platforms form part of the listed building but do not contribute to its heritage value.

4.5.43 The Grade II* listed Citadel Station (also known as Carlisle Station) (OR002_0079) will be directly physically impacted by the construction of the Proposed Scheme. This involves the construction of a new footbridge between platform 1 and a new platform (platform 0), the provision of a new passenger lift and stairs access via a subway created in the existing undercroft. However, the physical impacts are not to the architectural elements which contribute most to the station's heritage value, as noted above. The Proposed Scheme will alter the traditional layout of platforms 1 and 2 and introduce a new footbridge (between platform 1 and the new platform 0) in proximity to the island buildings and the wall. This will reduce the legibility of the historic layout of the station and ability to appreciate the heritage value of the station, in particular the relationship between the station and the detached west wall will be altered. This will constitute a low impact and result in a moderate adverse significant effect.

4.5.44 The following significant effects will occur as a result of permanent impacts on designated or non-designated heritage assets due to changes to their settings.

4.5.45 The Grade II listed Detached West Wall of Citadel Station (OR002_0173), is of high value. It has group value with the Citadel Station as it was formerly joined to the main building by a glazed roof over the later island and southern platforms. The new platform 0 will be offset from the Grade II listed Detached West Wall of Citadel Station (OR002_0173) by 2.5m. There will be no physical impact to the wall. The introduction of the new footbridge and lift access (described above) and changes to the platform layout will alter the legibility of the historic layout of the station. This will reduce the ability to appreciate the heritage value of the wall, in particular the relationship between the Detached West Wall and the Grade II* listed

station buildings. This will constitute a low impact and result in a moderate adverse significant effect.

Other mitigation measures

4.5.46 Potential opportunities for further mitigation measures will continue to be considered through detailed design to reduce further the significant effects described above where practicable. These may include the identification of locations where the physical impacts on heritage assets can be reduced through the detailed design of the works.

Summary of likely residual significant effects

4.5.47 The temporary effects of construction activity on the setting of heritage assets have been considered. However, as these effects result from temporary construction activities they are restricted to the duration of those activities and are reversible.

4.5.48 Specific mitigation measures have been incorporated as set out above and taken into account during assessment. Therefore, the residual effects are the same as those reported under permanent construction phase effects.

Cumulative effects

4.5.49 No cumulative effects on heritage assets during construction have been identified within the Carlisle Station area.

Effects arising from operation

Avoidance and mitigation measures

4.5.50 No mitigation measures are proposed in relation to the historic environment during the operation of the Proposed Scheme in the Carlisle Station area.

Assessment of impacts and effects

4.5.51 The assessment considers the Proposed Scheme once operational; all effects are permanent.

4.5.52 During the operation of the Proposed Scheme no further physical impacts affecting the Grade II* listed Citadel Station (also known as Carlisle Station) (OR002_0079) are anticipated. As such, there would be no further physical impacts on heritage assets arising from the operation of the Proposed Scheme.

4.5.53 Impacts on the Grade II listed Detached West Wall of Citadel Station (OR002_0173) arise from changes to its setting due to the presence of the Proposed Scheme and are reported as permanent construction effects. These effects are not repeated but will continue throughout the operation of the Proposed Scheme.

Other mitigation measures

4.5.54 The Proposed Scheme includes a number of design measures to address potential impacts and significant effects. Although no operational mitigation measures relevant to the assessment of effects on heritage assets have been identified, potential opportunities for further mitigation will be considered as part of the detailed design process.

Summary of likely residual significant effects

4.5.55 No mitigation beyond that described above has been identified. As a result, it is currently anticipated that residual effects will be the same as those reported in the assessment of effects during operation.

Cumulative effects

4.5.56 No cumulative effects on heritage assets during operation have been identified in the Carlisle Station area.

Monitoring

4.5.57 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

4.5.58 No area-specific heritage monitoring requirements during operation of the Proposed Scheme have been identified.

4.6 Socio-economics

Introduction

4.6.1 This section reports on the environmental baseline, likely economic and employment impacts, as well as significant effects during construction and operation of the Proposed Scheme within the Carlisle Station area. The assessment considers existing businesses, community organisations, local employment and local economies, including planned growth and development.

4.6.2 The socio-economic effects on employment at a route-wide level are reported in Volume 3, Route-wide effects, Section 12. Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 4.1.

Scope, assumptions and limitations

4.6.3 The scope, assumptions and limitations for the socio-economics assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology

Report[66]. The assessment of in-combination effects draws upon the findings of other technical disciplines (e.g. air quality, sound, noise and vibration, and traffic and transport).

Environmental baseline

Existing baseline

Study area description

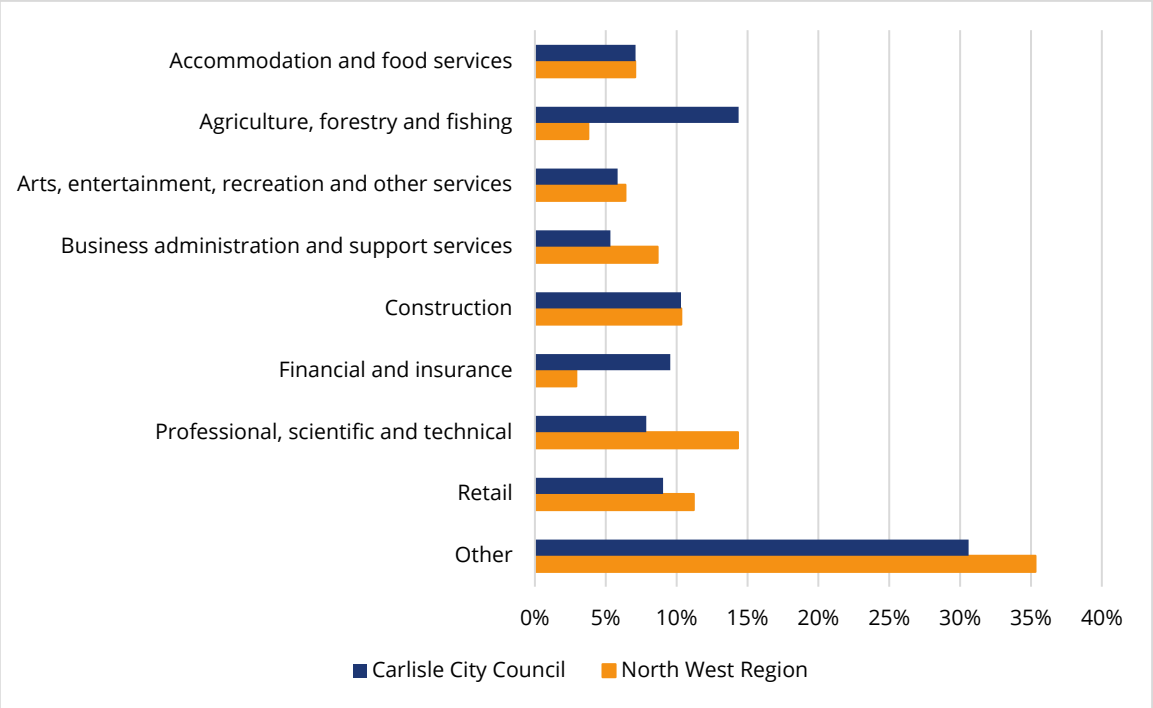
4.6.4 The following provides a brief overview of employment, economic structure, labour market and business premises availability within the Carlisle Station area which lies within the administrative area of Carlisle City Council (CaCC) and within the North West region.

Business and labour market

4.6.5 Within the CaCC administrative area, there is a wide spread of business types reflecting a diverse range of commercial activities. In 2020, the agriculture, forestry and fishing sector accounted for the largest proportion of businesses (14%), with construction the second largest (10%), followed by financial and insurance (10%) and retail (9%), as shown in Figure 10. By comparison, the largest sectors in the North West region were professional, scientific and technical (14%) and retail (11%), followed by construction (10%) and business administration and support services (9%)[67].

[66] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report.*
[67] Office for National Statistics (2020), *UK Business Counts – local units by industry and employment size band 2020*. Available online at: http://www.nomisweb.co.uk/datasets/idbrlu.

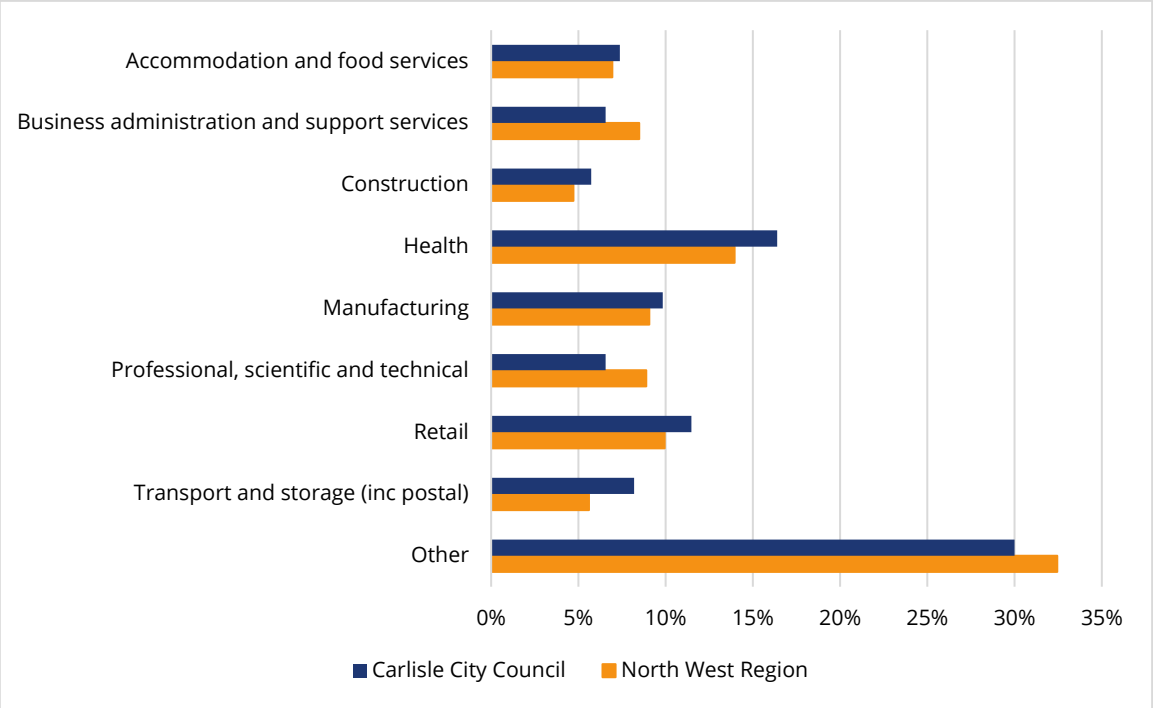
Figure 10: Business sector composition in the Carlisle City Council area and North West Region



4.6.6 In 2019[68], approximately 61,000 people worked in the CaCC area. According to the Office for National Statistics Business Register and Employment Survey 2019, the top four sectors in terms of share of employment were: health (16%); retail (11%); manufacturing (10%); and transport and storage (inc postal) (8%). These compare with the top four sectors for the North West region, which were: health (14%); retail (10%); manufacturing (9%); and professional, scientific and technical (9%), as shown in Figure 11.

[68] Office for National Statistics (2019), *Business Register and Employment Survey: open access 2019*. Available online at: http://www.nomisweb.co.uk/datasets/newbres6pub. This number includes both residents and non-residents of CaCC who work within its boundaries.

Figure 11: Employment by industrial sector in the Carlisle City Council area and North West Region



4.6.7 According to the Annual Population Survey (2020)[69], the employment rate[70] within the CaCC area was 77% (51,100 people), which is higher than that recorded for both the North West region (74%) and England (76%). In 2020, unemployment in the CaCC area was 5.4%, which was higher than that recorded for the North West region (4.3%) and England (4.8%).

4.6.8 The Annual Population Survey (2020)[19] also shows that 35% of CaCC residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, which was lower than that recorded in the North West (39%) and England (43%), while 5.6% of residents had no qualifications, which was lower than that recorded both for the North West region (7.5%) and England (6.2%).

Future baseline

Construction (2025)

4.6.9 Volume 5: Appendix CT-004-OR002 provides details of the developments in the Carlisle Station area that are assumed to have been implemented by 2025. The following committed development of relevance to socio-economics that would materially alter the future baseline during construction of the Proposed Scheme in this area, is set out in Table 10.

[69] Office for National Statistics (2020), *Annual Population Survey*. Available online at: http://www.nomisweb.co.uk/datasets/apsnew. This number includes the jobs held by residents of CaCC irrespective of where they work.

[70] The proportion of working age (16 – 64 year olds) residents that are in employment.

Table 10: Committed development of relevance to socio-economics during construction

Map book reference[71]	Planning reference	Description	How this is considered in the assessment
CSTM/044	18/0996	Location: Citadel Railway Station, Virgin Trains, Court Square, Carlisle, CA1 1QZ. Conversion of undercroft space to multi-use performance space including bar, W.C.'s and ancillary rooms; creation of new access via existing tunnel from Water Street.	Informing future baseline.

4.6.10 Implementation of committed development CSTM/044 could result in 10 additional jobs, altering the future baseline against which the Proposed Scheme is assessed. As such, this committed development has been included as part of the future baseline and considered within this assessment.

4.6.11 The existing composition and numbers of employers, employees and economic sectors in the area is likely to change over time in ways that cannot be accurately forecast.

Operation (2038)

4.6.12 Volume 5: Appendix CT-004-OR002 also provides details of the developments in the Carlisle Station area that are assumed to have been implemented by 2038. No additional committed developments of relevance for socio-economics have been identified that would materially alter the future baseline in this area.

Effects arising during construction

Avoidance and mitigation measures

4.6.13 The draft Code of Construction Practice (CoCP)[72] includes a range of provisions that will help mitigate socio-economic effects associated with construction within this area, including:

- reducing nuisance through the sensitive layout of construction sites (Section 5);
- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (Section 12);
- applying best practicable means during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses) (Section 13);
- monitoring and managing flood risk and other extreme weather events that may affect socio-economic resources during construction (Section 16);

[71] Volume 5: Planning Data/Committed Development Map Book: Map CT-13-802.

[72] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP).*

- site-specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (Section 14); and
- maintaining access to businesses for the duration of construction works where reasonably practicable (Section 14).

Assessment of impacts and effects

Temporary effects

Business

4.6.14 Businesses directly affected are reported in groups, where possible, to form defined resources based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier or that similar businesses and resources may be clustered together.

4.6.15 Overall, two resources in the study area will experience temporary direct impacts as a result of the Proposed Scheme. These are as follows:

- a storage unit under the railway arches; and
- a railway station car park.

4.6.16 It is estimated that fewer than 10 jobs[73] are provided by the businesses affected. Businesses with an interest in land, either being acquired or possessed by the Proposed Scheme, that can demonstrate a loss of profit will be compensated in accordance with the Compensation Code.

4.6.17 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents along the route of the Proposed Scheme in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that promotes further economic growth across the UK.

In-combination effects

4.6.18 No businesses have been identified within the Carlisle Station area that are expected to experience significant in-combination effects as a result of the Proposed Scheme.

Isolation

4.6.19 No businesses have been identified within the Carlisle Station area that are expected to experience significant isolation effects as a result of the Proposed Scheme.

[73] Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency (HCA) Employment Densities Guide 3rd Edition (2015). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary significantly from actual employment at the sites.

Construction employment

4.6.20 There will be one main civil engineering compound (South George Street main compound) and one civil engineering satellite compound in the Carlisle Station area. The satellite compound will continue to be used as a railway systems compound following the completion of civil engineering works. Up to 220 person years of construction employment opportunities will be created at these sites[74], broadly equivalent to 20 full-time jobs[75]. Depending on the skill levels required and the skills of local people, these jobs are potentially accessible to residents in the locality and to others living further afield. The impact of the direct construction employment creation has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).

4.6.21 Direct construction employment could lead to opportunities for local businesses to supply the Proposed Scheme or to benefit from expenditure of construction workers. The impact of indirect construction employment creation has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).

4.6.22 The resulting effects on construction employment are reported in aggregate at a route-wide level (see Volume 3, Route-wide effects).

Permanent effects

Businesses

4.6.23 Businesses directly affected, comprising those that lie within land required for the Proposed Scheme, are reported in groups, where possible, to form defined resources based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier or that similar businesses and resources are clustered together.

4.6.24 Overall, one resource within the study area will experience direct impacts as a result of the Proposed Scheme. This is a storage unit under the railway arches.

4.6.25 It is expected that there will be no significant permanent direct effects as a result of land required for the Proposed Scheme. Across all of the employment areas reviewed, it is estimated fewer than 10 jobs[76] will either be displaced or possibly lost within the Carlisle Station area. The impact from the relocation or loss of jobs is considered to be negligible in

[74] Construction labour is reported in construction person years, where one construction person year represents the work done by one person in a year composed of a standard number of working days.

[75] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

[76] Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency Employment Densities Guide 3rd Edition (2015). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary significantly from actual employment at the sites.

the context of the total number of people employed in CaCC (approximately 61,000 jobs) and the scale of economic activity and opportunity in the area.

Other mitigation measures

4.6.26 Businesses displaced by the Proposed Scheme will be compensated in accordance with the Compensation Code. HS2 Ltd recognises the importance of businesses displaced from their existing premises being able to relocate to suitable alternative premises and will, therefore, offer additional support over and above statutory requirements to facilitate this process[77,78]. Businesses with an interest in land that is either being acquired or possessed temporarily for the construction of the Proposed Scheme may also be eligible for compensation in accordance with the Compensation Code.

4.6.27 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents in the Carlisle Station area in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that promotes further economic growth across the UK.

Summary of likely residual significant effects

4.6.28 There are no significant effects identified in the assessment that will arise during construction of the Proposed Scheme.

Cumulative effects

4.6.29 No significant cumulative temporary or permanent effects during construction have been identified.

Effects arising from operation

Avoidance and mitigation measures

4.6.30 No mitigation measures are proposed in relation to business resources during operation of the Proposed Scheme.

Assessment of impacts and effects

4.6.31 No resources are expected to experience significant direct socio-economic, in-combination or isolation effects during the operation of the Proposed Scheme.

[77] High Speed Two Ltd (2022), *Phase 2b Western Leg Information Paper C7: Business relocation*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[78] High Speed Two Ltd (2022), *Phase 2b* Western Leg *Information Paper C8: Compensation code for compulsory purchase.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

Operational employment

4.6.32 Operational employment will be created at locations along the route including stations, train crew facilities and infrastructure/maintenance depots. Within the Carlisle Station area there will be 400 HS2-related train crew jobs based at the existing station. These employment opportunities will be accessible to residents within the locality.

4.6.33 Direct operational employment created by the Proposed Scheme could also lead to indirect employment opportunities for local businesses in terms of supplying the project or benefiting from expenditure of directly employed workers on goods and services.

4.6.34 Some of these employment opportunities will be accessible to residents in the locality and, given the transport accessibility within the local area, to residents living further afield.

4.6.35 The impact of operational employment creation has been assessed as part of the route-wide assessment (see Volume 3, Route-wide effects).

Other mitigation measures

4.6.36 No further mitigation measures have been identified for socio-economic receptors.

Summary of likely residual significant effects

4.6.37 There are no significant effects arising during operation of the Proposed Scheme.

Cumulative effects

4.6.38 No significant cumulative effects on socio-economic receptors have been identified in the Carlisle Station area during operation of the Proposed Scheme.

Monitoring

4.6.39 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

4.6.40 On the basis of there being no significant residual operational effects, there are no area-specific requirements for monitoring socio-economic effects during the operation of the Proposed Scheme in the Carlisle Station area.

4.7 Sound, noise and vibration

Introduction

4.7.1 This section reports the assessment of the noise and vibration likely significant effects arising from the construction and operation of the Proposed Scheme within the Carlisle Station area on:

- residential receptors such as people, primarily where they live, in terms of individual dwellings and on a wider community basis including any shared community open areas; and
- non-residential receptors such as:
  - community facilities including schools, hospitals, places of worship and quiet areas; and
  - commercial properties such as hotels.

4.7.2 'Shared community open areas' are those that the Planning Practice Guidance[79] identifies may partially offset a noise effect experienced by residents at their dwellings and are either a) relatively quiet nearby external amenity spaces for sole use by a limited group of residents as part of the amenity of their dwellings or b) a relatively quiet external publicly accessible amenity space (e.g. park or local green space) that is nearby.

4.7.3 Non-residential receptors with multiple uses were assessed either based on the most noise sensitive use or were subject to multiple assessments as appropriate.

4.7.4 'Quiet Areas' are defined in the EIA Scope and Methodology Report (SMR)[80] as:

- areas designated under Local Plans as being prized for their tranquillity;
- areas designated under Local Plans or Neighbourhood Development Plans as Local Green Spaces; and
- areas identified as Quiet Areas through implementation of the Environmental Noise (England) Regulations 2006[81,82].

4.7.5 The methodology for the assessment of likely significant noise and vibration effects was developed in line with UK Government noise policy[83], planning policy, planning practice guidance on noise (PPGN)[84] and Environmental Impact Assessment (EIA) Regulations as described in the SMR[80].

4.7.6 Engagement has been undertaken with Carlisle City Council with respect to the sound, noise and vibration assessment. The purpose of this engagement has been twofold. Engagement has been undertaken covering matters including process, scope, method, approach to baseline and mitigation strategy. Officers from local authorities have been invited to attend

[79] Ministry of Housing, Communities and Local Government (2014), National Planning Practice Guidance – Noise. Available online at: http://planningguidance.planningportal.gov.uk.

[80] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

[81] *Environmental Noise (England) Regulations 2006 (SI 2006/2238).* Available online at: https://www.legislation.gov.uk/uksi/2006/2238.

[82] *Environmental Noise (England) (Amendment) Regulations 2009 (SI 2009/1610).* Available online at https://www.legislation.gov.uk/uksi/2009/1610.

[83] Department for Environment, Food and Rural Affairs (Defra) (2015), *Noise Policy Statement for England,* Available online at: https://www.gov.uk/government/publications/noise-policy-statement-for-england.

[84] Department for Communities and Local Government (DCLG) (2019), *Planning Practice Guidance – Noise*, Available online at: https://www.gov.uk/guidance/noise--2.

and witness baseline sound measurements. Where appropriate, relevant information identified by the authorities has been taken into account in the assessment. Engagement with local and county authorities will continue as part of the development of the Proposed Scheme.

4.7.7 More detailed information regarding the sound, noise and vibration assessment for the Carlisle Station area is available in Volume 5:

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-00000); and
- sound, noise and vibration baseline and construction assessment (Appendix SV-001-OR002).

4.7.8 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. Mapping to support the sound, noise and vibration assessment is presented in Map Series SV-03 (Volume 5, Sound, noise and vibration Map Book). The Proposed Scheme is described in Section 4.1.

4.7.9 The assessment of likely significant effects from noise and vibration on heritage receptors and socio-economics are presented in the historic environment and socio-economic assessments reported in this section respectively.

4.7.10 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

4.7.11 The scope, assumptions and limitations for the sound, noise and vibration assessment are set out in Volume 1, Introduction and methodology, Section 8 and the SMR[29] and Volume 5: Appendix SV-001-00000.

4.7.12 The approach to assessing sound, noise and vibration and identifying envisaged mitigation is outlined in Volume 1, Introduction and methodology, Section 8 and Section 9, and the SMR.

4.7.13 In this assessment 'sound' is used to describe the acoustic conditions that people experience as a part of their everyday lives. Noise is taken as unwanted sound and hence adverse effects are noise effects and mitigation is, for example, by noise barriers.

4.7.14 The assessment of construction vibration has been undertaken for residential and non-residential receptors located up to 85m from the nearest construction activity, and up to 200m for non-residential receptors/land uses where low ambient vibration or sound is critical to operations. The assessment of construction noise has been undertaken for residential and non-residential receptors located up to 300m from the nearest construction activity or the area within which the sound levels are forecast to give rise to potential impacts, whichever is greater.

4.7.15 The construction arrangements that form the basis of the assessment are presented in Section 4.1 of this report, in Volume 1, Introduction and methodology, Section 8 and in the draft Code of Construction Practice (CoCP)[85].

4.7.16 The assessment takes account of people's sensitivity to noise during the day, evening and night-time[86]. More stringent criteria are applied during evening and night-time periods, compared to the busier and more active daytime period.

4.7.17 It is likely that the majority of receptors adjacent to the Proposed Scheme are not currently subject to appreciable vibration[87]. The predicted vibration levels at all receptors as a result of the Proposed Scheme, has, therefore been assessed using specific absolute thresholds, below which receptors will not be affected by vibration, rather than vibration change criteria. Further information is provided in Volume 1, Introduction and methodology, Section 8.

Environmental baseline

Existing baseline

4.7.18 The area around Carlisle Station is predominantly urban, with land use comprising industrial, business, retail and leisure. There are limited residential properties within the vicinity of Carlisle Station.

4.7.19 The sound environment is generally dominated by local and distant road and rail traffic, including the West Coast Main Line (WCML) and local lines serving Carlisle Station. Local neighbourhood sources of sound from commercial facilities and nature (such as bird song and trees) also contribute to sound levels in the area.

4.7.20 There are several main roads within the Carlisle Station area, including the A6 Roman Road/Carleton Road/London Road/Botchergate. Other main roads that contribute to the sound environment are the A595 Castle Way, the A7 Spencer Street/Georgian Way/Victoria Place/Lowther Street, and the A69 Rotary Way/Warwick Road/Victoria Place.

4.7.21 Sound levels close to these main transportation routes are high during the daytime and are generally lower at night-time. Sound levels decrease with increasing distance from the main transportation routes.

4.7.22 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for the Carlisle Station area in Volume 5: Appendix SV-001-OR002.

[85] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

[86] Day, evening and night-time periods are defined in Volume 5: Appendix SV-001-00000, Sound, noise and vibration methodology, assumptions and assessment.

[87] Further information is available in the Volume 5: Appendix SV-001-00000, Sound, noise and vibration methodology, assumptions and assessment report and the Volume 5: Appendix CT-001-0001, Environmental Impact Assessment Scope and Methodology Report.

Future baseline

4.7.23 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth, which may be as a result of local or national trends or due to specific committed developments. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads. On higher speed roads, tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

4.7.24 Committed developments involving sound or vibration sensitive uses within the relevant study area have been included within the assessment and are reported for the Carlisle Station area in Volume 5: Appendix SV-001-OR002[88]. Where applicable, noise or vibration significant effects on these committed developments are discussed in this section.

Construction

4.7.25 The assessment of noise from construction activities assumes a future construction baseline year of 2026, which represents the period immediately prior to the start of the construction period. As a reasonable worst-case, it has been assumed that no change in baseline sound levels will occur between the existing baseline year of 2018 and the future construction baseline year of 2026.

4.7.26 The peak level of construction traffic activity for the Proposed Scheme is expected to occur in 2028.

Effects arising during construction

Avoidance and mitigation measures

4.7.27 The assessment assumes the implementation of the principles and management processes set out in the noise and vibration section of the draft CoCP, Section 13, which are:

- best practicable means (BPM) as defined by the Control of Pollution Act 1974 (CoPA)[89] and Environmental Protection Act 1990 (EPA), which will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties and other sensitive receptors (including local businesses and quiet areas designated by the local authority);
- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example, the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on-site, control of working hours, the provision of

[88] Volume 5: Appendix CT-004-OR002 provides details of all the developments assumed to be implemented.

[89] *Control of Pollution Act 1974.* Her Majesty's Stationery Office, London. Available online at: https://www.legislation.gov.uk/ukpga/1974/40/contents.

acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings;

- screening: for example, local screening of equipment or perimeter hoarding or the use of temporary stockpiles; and
- where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary rehousing will be offered at qualifying properties.

- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of the CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise and vibration, including control of working hours, and provide a further assessment of construction noise and vibration, including confirmation of noise insulation/temporary rehousing provision;
- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to, and be reviewed by, the nominated undertaker and made available to the local authorities; and
- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the nominated undertaker as required to ensure compliance.

4.7.28 Noise insulation will be offered for qualifying buildings as defined in the draft CoCP. Noise insulation or, where appropriate, temporary rehousing will avoid residents being significantly affected by levels of construction noise inside their dwellings. The assessment reported in this section provides an estimate of the buildings that are likely to qualify for noise insulation. The assessment shows that none are predicted to qualify for noise insulation or temporary rehousing.

4.7.29 Qualification for noise insulation and, where appropriate, temporary rehousing will be confirmed, as part of seeking prior consent from the local authority under Section 61 of the CoPA. Qualifying buildings will be identified, as required in the draft CoCP, so that noise insulation can be installed, or where appropriate any temporary rehousing provided, before the start of the works predicted to exceed noise insulation or temporary rehousing criteria.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings and communities

4.7.30 The avoidance and mitigation measures to be implemented during construction will reduce airborne construction noise adverse effects on individual dwellings and communities, to an extent that the assessment of construction noise and vibration indicates that significant sound, noise or vibration effects are unlikely at any individual dwellings or community within this area. Further information on the assessment of effects on individual dwellings is presented in Volume 5: Appendix SV-001-OR002.

Residential receptors: indirect effects

4.7.31 Construction traffic is not likely to cause adverse noise effects on any occupants of dwellings in the Carlisle Station area.

Non-residential receptors: direct effects

4.7.32 The assessment has identified the following non-residential receptors where the predicted airborne noise levels exceed both the relevant impact screening criteria and the noise change criterion (typically a change of greater than 3dB[90] compared with the existing baseline sound level).

- Viaduct House (Offices), Victoria Viaduct, Carlisle (Assessment Location reference: 619118);
- The Citadel, English Street, Carlisle (Assessment Location reference: 619001);
- Carlisle Enterprise Centre, James Street, Carlisle (Assessment Location reference: 619052);
- The Hallmark Hotel, Court Square, Carlisle (Assessment Location reference: 619000);
- Vue Cinema, Botchergate, Carlisle (Assessment Location reference: 619009);
- Studio A Dance Company, Crown Street, Carlisle (Assessment Location reference: 619010);
- Hebron Evangelical Church, Botchergate, Carlisle (Assessment Location reference: 619011);
- Unit 16, St Nicholas Estate, Lancaster Street, Carlisle (Assessment Location reference: 619127); and
- Vasey and Sons (Carlisle) Ltd, Lancaster Street, Carlisle (Assessment Location reference: 619125).

4.7.33 At each of the non-residential receptors identified above an assessment has been undertaken to determine if this impact would result in a significant effect, using the significance criteria set out in Annex A of Volume 5: Appendix SV-001-00000.

4.7.34 Viaduct House, is an office building located off the Victoria Viaduct approximately 10m north of the land required for the South George Street main compound. The multi-storey building features double glazed openable windows. The southern facade of the building faces the Proposed Scheme. Viaduct House has been assessed against the office criteria. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for office use[91] for a period of nine months. The typical and highest predicted daytime monthly construction noise levels at this building are 5dB(A) and 11dB(A) respectively above the screening criteria defined in the SMR. Viaduct House is identified, on

[90] The exception is where the use and sensitivity of the receptor or land use is very sensitive to noise and have been included in the detailed assessment where there is a change less than 3dB. Further information can be found in Volume 5: Appendix SV-001-OR002.

[91] 55 dB $L_{pAeq,0700-2300}$ (free-field) during the day, which is equivalent to 58 dB $L_{pAeq,0700-2300}$ (facade).

the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by CSTN-C-N1 in Table 7, Volume 5: Appendix SV-001-OR002). This temporary adverse effect may take the form of activity disturbance to people working in the offices.

4.7.35 The Citadel is a building owned by Cumbria County Council (CCC) which is used as an office and is located off English Street approximately 25m north of the land required for the South George Street main compound. The building features single glazed windows. The southern facade of the building faces the Proposed Scheme. The Citadel has been assessed against the office criteria. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for office use[91] for a period of nine months. The typical and highest predicted daytime monthly construction noise levels at this building are 2dB(A) and 6dB(A) respectively above the screening criteria defined in the SMR. The Citadel is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by CSTN-C-N2 in Table 7, Volume 5: Appendix SV-001-OR002). This temporary adverse effect may take the form of activity disturbance to people working in the offices.

4.7.36 Carlisle Enterprise Centre is an office building located off James Street approximately 50m west of the land required for the South George Street main compound. The two-storey building features double glazed openable windows. The eastern facade of the building faces the Proposed Scheme. Carlisle Enterprise Centre has been assessed against the office criteria. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for office use[91] for a period of 21 months. The typical and highest predicted daytime monthly construction noise levels at this building are 6dB(A) and 8dB(A) respectively above the screening criteria defined in the SMR. Carlisle Enterprise Centre is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by CSTN-C-N3 in Table 7, Volume 5: Appendix SV-001-OR002). This temporary adverse effect may take the form of activity disturbance to people working in the offices.

4.7.37 The Hallmark Hotel is located off Court Square located immediately north of the land required for the South George Street main compound. The multi-storey building features double glazed openable windows. The southern facade of the building faces the Proposed Scheme. Viaduct House has been assessed against the hotel criteria. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for hotel use[92] for a period of 15 months. The typical and highest predicted daytime monthly construction noise levels at this building are 12dB(A) and 17dB(A) respectively above the screening criteria defined in the SMR. Hallmark Hotel is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by CSTN-C-N4 in Table 7, Volume 5: Appendix SV-001-OR002). This temporary adverse effect may take the form of activity disturbance to workers and guests at the hotel.

[92] 50 dB $L_{pAeq,0700-2300}$ (free-field) during the day, which is equivalent to 53 dB $L_{pAeq,0700-2300}$ (facade).

4.7.38 Vue Cinema is located off Botchergate, approximately 30m north of the land required for the South George Street main compound. Noise level predictions have been made based on the southern facade facing the Proposed Scheme, which contains no windows. Noise levels at facades with windows are predicted to be lower than the presented sound levels. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for this use[93] for a period of nine months. The typical and highest predicted daytime monthly construction noise levels at this building are 8dB(A) and 13dB(A) respectively above the screening criteria defined in the SMR. In this situation, the construction noise levels at facades with windows are likely to be below the screening criteria and a likely significant effect is not identified at Vue Cinema.

4.7.39 Studio A Dance Company teaches dancing and is located off Crown Street approximately 30m north of the land required for the South George Street main compound. The multi-storey building features single glazed openable windows. The southern facade of the building faces the Proposed Scheme. Studio A Dance Company has been assessed against the educational criteria. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for this use[91] for a period of six months. The typical and highest predicted daytime monthly construction noise levels at this building are 11dB(A) and 12dB(A) respectively above the screening criteria defined in the SMR. Studio A Dance Company is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by CSTN-C-N5 in Table 7, Volume 5: Appendix SV-001-OR002). This temporary adverse effect may take the form of activity disturbance to workers and students at the dance studio.

4.7.40 The Hebron Evangelical Church is located off Botchergate located approximately 80m north of the land required for the South George Street main compound. The side of the building closest to the compound is a single-storey. Noise level predictions have been made based on the southern facade facing the Proposed Scheme, which contains no windows. However, there are windows on the western facade closest to the Proposed Scheme. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR[94] for this use for a period of six months. The typical and highest predicted daytime monthly construction noise levels at this building are both 11dB(A) above the screening criteria defined in the SMR. The Hebron Evangelical Church is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by CSTN-C-N6 in Table 7, Volume 5: Appendix SV-001-OR002). This temporary adverse effect may take the form of activity disturbance to people working in or visiting the church.

4.7.41 Unit 16, St Nicholas Estate, is a committed development (planning reference CSTN/146), which includes a proposal to demolish the existing warehouse and construct a new single-storey warehouse with ancillary office space. The south-west facade of the proposed committed development faces the Proposed Scheme. Unit 16, St Nicholas Estate has been assessed against the lower sensitivity office criteria. The predicted daytime monthly

[93] 50 dB $L_{pAeq,0700-2300}$ (free-field) during the day, which is equivalent to 53 dB $L_{pAeq,0700-2300}$ (facade).

[94] 50 dB $L_{pAeq,0700-2300}$ (free-field) during the day which is equivalent to 53 dB $L_{pAeq,0700-2300}$ (facade).

construction noise level is above the screening criteria defined in the SMR for lower sensitivity office use[95] for a period of six months. The highest predicted daytime monthly construction noise level at this building is 1dB(A) above the screening criteria defined in the SMR. The typical predicted daytime monthly construction noise level at this building is below the screening criteria defined in the SMR. Given the small increase in baseline noise levels for a short duration, a likely significant effect is not identified at Unit 16, St Nicholas Estate.

4.7.42 Vasey and Sons (Carlisle) Ltd is a retail building with associated offices located on Lancaster Street approximately 50m south-east of the land required for platform extension works at Carlisle Station. The offices are located on the first floor of the south-west facade of the building facing the Proposed Scheme. The offices have double glazed windows which may be opened for ventilation. Vasey and Sons (Carlisle) Ltd has been assessed against the lower sensitivity office criteria. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for lower sensitivity office use[95] for a period of six months. The typical and highest predicted daytime monthly construction noise levels at this building are both 3dB(A) above the screening criteria defined in the SMR. Vasey and Sons (Carlisle) Ltd is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by CSTN-C-N7 in Table 7, Volume 5: Appendix SV-001-OR002). This temporary adverse effect may take the form of activity disturbance to people working in the offices.

Non-residential receptors: indirect effects

4.7.43 Construction traffic is not likely to cause adverse noise effects on any non-residential receptors in the Carlisle Station area.

Other mitigation measures

4.7.44 No other mitigation measures are proposed in this area.

Summary of likely residual significant effects

4.7.45 The proposed avoidance and mitigation measures will reduce noise inside all individual dwellings from the construction activities such that residents will not be significantly affected[96].

4.7.46 At the community level, the measures will also reduce the construction noise effects on acoustic character in the majority of residential communities. The assessment of construction noise and vibration indicates that significant sound, noise or vibration effects are unlikely to occur on communities in this area.

4.7.47 Noise from specific construction activities has been identified as resulting in significant residual temporary effects on the non-residential buildings at:

[95] 65 dB $L_{pAeq,0700-2300}$ (facade) during the day, based on Category A of the BS5228 ABC method.

[96] Refer to Volume 5: Appendix SV-001-00000.

- Victoria House, Victoria Viaduct, Carlisle;
- The Citadel, English Street, Carlisle;
- Carlisle Enterprise Centre, James Street, Carlisle;
- The Hallmark Hotel, Court Square, Carlisle;
- Studio A Dance Company, Crown Street, Carlisle;
- Hebron Evangelical Church, Botchergate, Carlisle; and
- Vasey and Sons (Carlisle) Ltd, Lancaster Street, Carlisle.

4.7.48 HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptor(s), its/their use and the benefit of the measures.

Cumulative effects

4.7.49 This assessment has considered the potential cumulative construction noise effects of the Proposed Scheme and other committed developments[97]. It is not anticipated that there will be any significant cumulative noise effects during construction of the Proposed Scheme.

Effects arising from operation

Assessment of impacts and effects

4.7.50 Given the nature of the works, direct and indirect operational effects are not anticipated and therefore no assessment is presented for the works associated with the Proposed Scheme in this section of the report. The potential permanent indirect operational effects associated with the works at Carlisle Station are considered further in Section 5.3 of this report.

Monitoring

4.7.51 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

4.7.52 Operational noise and vibration monitoring will be carried out at different times during the lifetime of the Proposed Scheme at a combination of carefully selected monitoring locations. The locations will be: adjacent or attached to moving vehicles; at fixed positions or in the vicinity of individual assets; and locations within the surrounding areas and communities alongside the railway corridor.

4.7.53 The expected noise and vibration performance of the Proposed Scheme, operational noise and vibration measurement data, associated asset information, description of corrective actions, results of measured performance compared to expected conditions, and monitoring reports will be shared with the relevant local authorities at appropriate intervals.

[97] Refer to Volume 5: Appendix CT-004-OR002, Planning data.

4.8 Traffic and transport

Introduction

4.8.1 This section considers the likely impacts on all forms of transport and the consequential potential significant effects on transport users arising from the construction and operation of the Proposed Scheme within the Carlisle Station area. The effects on traffic and transport are assessed quantitatively, based on existing baseline traffic conditions and future scenarios.

4.8.2 Engagement with Highways England, Cumbria County Council (CuCC), and Carlisle City Council (CaCC) has been undertaken. An important focus of this engagement has been to obtain relevant baseline information and discuss transport survey requirements and assessment methodology.

4.8.3 A detailed report on traffic and transport impacts within the Carlisle Station area is contained in Volume 5, Appendix TR-001-000, Transport Assessment Part 4.

4.8.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book.

4.8.5 Maps showing traffic and transport significant effects during construction (Map Series TR-03) and operation (Map Series TR-04) and construction routes to compounds (Map Series TR-08) can be found in Volume 5, Traffic and transport Map Book.

4.8.6 In addition, further traffic and transport data are set out in Background Information and Data (BID)[98] (see BID TR-004-00001: Transport Assessment policy and data).

4.8.7 The Proposed Scheme is described in Section 4.1.

Scope, assumptions and limitations

4.8.8 The scope, assumptions and limitations for the traffic and transport assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report[99].

4.8.9 This section considers the potential significant effects on transport users arising from the construction of the Proposed Scheme within the Carlisle Station area and improvements, alterations and adaptations to the existing Carlisle Station, both during construction and

[98] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[99] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

operation. The potential effects arising from changes in demand at Carlisle Station during operation are considered in Section 5.3 of this report.

4.8.10 The peak level of construction traffic activity for off-route works is expected to be 2028 and the opening year to be 2038. The forecasts used in the assessment have been produced prior to the development of a full understanding of the likely impact of COVID-19 on economic growth and travel behaviour. The full impact of COVID-19 is not yet known but is considered likely to result in lower travel demand in the medium term than the forecasts used in the assessment for background traffic and rail, including HS2.

4.8.11 The study area for traffic and transport includes the area immediately surrounding Carlisle Station (see Volume 4, Off-route effects Map Book, Map CT-05-803). The study area for traffic and transport also includes all strategic and local roads potentially affected by the Proposed Scheme including the M6 (including junctions 42 and 43).

4.8.12 For all roads, the baseline forecast traffic flows for the future years of assessment have been derived using the Department for Transport's (DfT) traffic forecasting tool, Trip End Model Presentation Program (TEMPro). The assessment covers the average weekday morning (08:00 – 09:00) and evening (17:00 – 18:00) peak hours.

4.8.13 Forecast future year traffic flows in this off-route assessment, with and without the Proposed Scheme, have been based on an approach that does not take account of wider effects such as redistribution and reassignment of traffic. This is consistent with the assessment of other phases of HS2. It is not considered that these wider changes will affect the conclusion of the assessment.

4.8.14 Where the effects vary through the construction programme the most significant effects are reported. Where there are both adverse and beneficial effects at different times, the most adverse and least beneficial are both reported.

Environmental baseline

Existing baseline

4.8.15 Existing conditions in the study area have been determined through site visits, traffic and transport surveys, liaison with Highways England, CuCC and CaCC (including provision of information on public transport, public rights of way (PRoW) and accident[100] data) and desktop analysis. Further information on the traffic and transport environmental baseline at Carlisle Station can be found in Section 5.3.

[100] The term accident in this report refers to injury related collisions reported to/recorded by the police. These data, known as STATS19, relate only to personal injury accidents on public roads that are reported to the police, and subsequently recorded, using the STATS19 accident reporting form.

Surveys

4.8.16 Traffic surveys, comprising junction turning counts, manual classified counts, queue length surveys and automatic traffic counts, were undertaken in October 2017, November 2017, March 2019 and July 2019. Car park and drop off surveys were undertaken in March 2017. Assessment of the data indicates that the weekday peak hours in the area are generally 08:00 – 09:00 and 17:00 – 18:00 which correspond to the Proposed Scheme assessment hours.

4.8.17 No PRoW will be impacted by the Proposed Scheme therefore no PRoW surveys were undertaken within the Carlisle Station area.

Strategic and local highway network

4.8.18 The M6 is the only strategic route that passes through the area. The strategic road network in and around the Carlisle Station area is generally busy during peak hours and delays can be experienced.

4.8.19 The local roads include (ordered by road class from south to north):

- A6 Roman Road/Carleton Road/London Road/Botchergate;
- A69 Rotary Way/Warwick Road/Victoria Place;
- A7 Spencer Street/Georgian Way/Victoria Place/Lowther Street;
- A595 Bridge Street/Castle Way;
- A595 Castle Way; and
- B5299 Shaddongate.

4.8.20 The local road network in this area generally operates well, although some localised delays can be experienced, particularly at peak times.

4.8.21 Relevant accident data for the road network subject to assessment have been obtained from the DfT[101]. Data for the three-year period from June 2016 to June 2019 have been assessed and any identified clusters (i.e. where there are nine or more accidents in the three-year period) have been examined.

4.8.22 Two accident clusters were identified within the Carlisle Station area that have the potential to be impacted by construction or operation of the Proposed Scheme:

- A595 Bridge Street/A595 Church Street/John Street/Byron Street – in total there were 11 accidents, all of which were classified as slight; and
- A7 Bridgewater Road/A7 Georgian Way/A595 Castle Way/Newmarket Road/Duke's Road (known locally as Hardwicke Circus) – in total there were 13 accidents, all of which were classified as slight.

[101] Department for Transport (2021), *STATS19 Road Safety Data June 2016 - June 2019*. Available online at: https://www.gov.uk/government/collections/road-accidents-and-safety-statistics.

Parking and loading

4.8.23 There is off-street car parking within the Carlisle Station area that may be impacted by the Proposed Scheme, including an off-street station car park accessed via South George Street and located immediately adjacent to the west of Carlisle Station.

4.8.24 Servicing of the existing Carlisle Station takes place from a servicing entrance on Court Square Brow.

Public transport network

4.8.25 The Carlisle Station area is well served by public transport with access to rail (via Carlisle Station) and buses via Carlisle Bus Station, located 325m to the north of Carlisle Station. Many bus routes also operate in the area. Together, they provide excellent connectivity between the city centre and the surrounding areas.

4.8.26 Bus routes 60, 60A, 61, 61A, 61B, 62, 62A, 64A, 67, 69, 74, 75, 76, 79, 91A, 104, 127A, 179, 382, 400, 680 and X95 operate on the roads in the vicinity of Carlisle Station, and are served by nine bus stops located on English Street, Devonshire Street and The Crescent, all within 400m walk of the entrance to Carlisle Station.

4.8.27 Where bus routes and stops are expected to be affected by either the construction or operation of the Proposed Scheme, these are referred to in the relevant assessment sections.

4.8.28 National and local rail services are accessible via Carlisle Station. Carlisle Station provides access to national services on the WCML. Local services on the Cumbrian Coast Line and the Newcastle Line are also accessed from Carlisle Station.

Non-motorised users

4.8.29 There are footways alongside most roads in the Carlisle Station area, together with PRoW including public footpaths in Carlisle city centre and adjacent to the River Caldew and River Eden. However, it is not expected that any PRoW will be affected by the Proposed Scheme.

4.8.30 National Routes 7 and 72 (part of the National Cycle Network) pass through the Carlisle Station area.

Waterways and canals

4.8.31 There are no navigable waterways within the Carlisle Station area potentially affected by the Proposed Scheme. Consequently, this topic is not considered further in this assessment.

Air transport

4.8.32 There is no relevant air transport within the Carlisle Station area. Consequently, this topic is not considered further in this assessment.

Future baseline

4.8.33 The future baseline traffic volumes have been calculated for the future year of 2028. This has been used to support the assessment of construction of the Proposed Scheme, reflecting the assumed construction peak (2028). Future baseline traffic volumes have also been calculated for the future year of 2046 to support the assessment of the operation of the Proposed Scheme, in relation to changes in passenger demand. Growth factors have been checked to ensure that committed developments are appropriately reflected in the growth forecasts. The assumptions underlying committed developments and transport schemes for each assessment year have been discussed with CuCC and are considered to be appropriately reflected in the traffic forecasts.

4.8.34 It is difficult to forecast how public transport services may change in the future; therefore, unless information on future services is available, it has been assumed that public transport services for the future years of assessment will be the same as those currently operating. Similarly, pedestrian and cycle demand and facilities and parking are assumed to remain unchanged from the base year. For the Carlisle Station area, there are no known substantial committed changes to the transport network, parking, pedestrian and cycling facilities.

Construction

4.8.35 Construction of the Proposed Scheme is expected to commence in 2026 with construction activity continuing to 2028. Construction activities have been assessed against 2028 baseline traffic flows, irrespective of when they occur during the construction period.

4.8.36 The year 2028 is the common future baseline year for off-route works and the impact of individual or overlapping activities are considered against this single year.

4.8.37 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 6.3% by 2028 compared to a baseline year of 2019.

Operation

4.8.38 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 16% by 2046 compared to a baseline of 2017.

Effects arising during construction

Avoidance and mitigation measures

4.8.39 The following measures are currently proposed to avoid or reduce effects on transport users:

- traffic management measures will be implemented to limit any disruption;
- heavy goods vehicles (HGV) will be routed, insofar as reasonably practicable, along the strategic and/or primary road network;

- the use of the local road network will, insofar as reasonably practicable, be limited to use for site set-up, access for surveys and ongoing servicing (including refuse collection and general deliveries to compounds) during construction;
- highway measures including junction improvements will be provided, as required, to manage the safe passing of construction vehicles on construction HGV routes;
- on-site welfare facilities will be provided, which will reduce highway trips by site workers; and
- delivery of materials and equipment will be made via the conventional rail network, insofar as reasonably practicable.

4.8.40 Section 14 of the draft Code of Construction Practice (CoCP)[102] includes measures that aim to reduce the adverse impacts and effects on local communities and maintain public access. This includes the impacts of deliveries of construction materials and equipment.

4.8.41 The measures in the draft CoCP include controls on vehicle types, hours of site operation and routes for HGVs to reduce the impact of road-based construction traffic. In order to achieve this, general and site-specific traffic management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads and PRoW affected by the Proposed Scheme.

4.8.42 The draft CoCP includes the requirement to develop local traffic management plans in consultation with the highway and traffic authorities and the emergency services. These will consider the local traffic management strategy including consideration of sensitive receptors, such that adverse impacts will be reduced, insofar as reasonably practicable.

4.8.43 Specific measures include core site operating hours of 08:00 to 18:00 on weekdays and 08:00 to 13:00 on Saturdays with site staff and workers generally arriving before the morning peak hour and departing after the evening peak hour. Activities such as major concrete pours may involve extended working hours for reasons of engineering practicability. However, workers will mostly arrive and depart outside of the peak traffic hours.

4.8.44 The number of private car trips to and from the construction compounds (both workforce and visitors) will be reduced by encouraging alternative sustainable modes of transport or vehicle sharing. This will be supported by an overarching framework travel plan that will require construction workforce travel plans to be produced that will include a range of potential measures to mitigate the impacts of workers' traffic and transport movements associated with construction of the Proposed Scheme. The travel plans will promote the use of sustainable transport modes as appropriate to the location and types of trip. They will include measures such as: provision of information on and promotion of public transport services; provision of good cycle and pedestrian facilities; liaison with public transport operators; promotion of car sharing; and the appointment of a travel plan coordinator to ensure suitable measures are in place and are effective.

[102] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

4.8.45 Where works potentially affect Network Rail assets, disruption to travelling passengers and freight movements will be reduced insofar as reasonably practicable. This includes measures such as:

- programming the construction works to coincide with the possessions that are required and planned by Network Rail for the general maintenance of their railway;
- planning the required construction works so that they can be undertaken in short overnight stages so that passenger services are not disrupted; and
- programming longer closures at the weekend and on bank holidays to reduce, insofar as reasonably practicable, the number of passengers affected.

Assessment of impacts and effects

Temporary effects

4.8.46 The following section considers the impacts on traffic and transport and the likely consequential significant effects resulting from the construction of the Proposed Scheme.

Key construction transport issues

4.8.47 The traffic and transport impacts during the construction period within the Carlisle Station area will include:

- construction vehicle movements to and from the construction compounds;
- possessions and blockades on the conventional rail network;
- impacts on the existing Carlisle Station, due to construction work which could affect users of the station and users of the adjacent highway network; and
- some loss of off-street car parking.

4.8.48 Construction vehicle movements required to construct the Proposed Scheme will include the delivery of plant and materials and site worker trips.

4.8.49 Details of the construction compounds are provided in Section 4.1. Table 11 details of the compound set up date and the duration of active use. The duration of active use excludes any period where there are no substantial workforce trips or movement of materials to and from the compound.

4.8.50 Table 11 also provides a summary of this along with the HGV and car/light goods vehicle (LGV) access trips at each compound in the peak month of activity and during the busy period. For each compound, the peak month of activity is the month within which HGV traffic is at its highest for that compound. The busy period is the period during which HGV traffic serving that compound will be greater than 50% of the HGV traffic in the peak month. Two-way trips refer to the total number of vehicle movements in both directions (e.g. with 200 westbound vehicles and 100 eastbound, there would be 300 two-way trips). The average daily combined two-way vehicle trips for the busy period is the lower end of the range

shown in Table 11 and the average daily combined two-way vehicle trips for the peak month is the upper end of the range shown. The estimated duration of busy period is also provided.

Table 11: Typical vehicle trip generation for construction compounds within the Carlisle Station area

Compound type	Compound name	Indicative start/set up date (years/ quarters)	Estimated duration of active use (years/ months)	Average daily combined two–way car/LGV trips during busy period and within peak month of activity	Average daily combined two–way HGV trips during busy period and within peak month of activity	Estimated duration of busy period (months)
Main	South George Street main compound	2026 Q4	1 year 9 months	72-88	14-20	17
Satellite	High Wapping Sidings satellite compound	2026 Q4	1 year 9 months	55-108	18-20	4

4.8.51 Table 12 summarises the access routes to and from each compound to the main road network. For some compounds, Table 12 includes multiple construction routes. This is either because the construction route varies depending on the origin/destination of the trip or because the construction route varies over time to account for changes to the highway network through the construction period.

4.8.52 The average daily combined two-way vehicle trips reported in Table 11 represent the total number of vehicle movements to and from each compound during the busy period and in the peak month of activity on all of the available construction routes combined. Where multiple routes are shown in Table 12, the split of construction traffic between the available routes will vary based on the point in the construction programme and the origin/destination of the traffic.

Table 12: Construction routes for construction compounds within the Carlisle Station area

Compound name(s)	Access routes to / from compound(s) to main road network
South George Street main compound	South George Street, Water Street, Currock Street, Robert Street, Crown Street, and A6 Botchergate
High Wapping Sidings satellite compound	Crown Street, Currock Street and A6 Botchergate

4.8.53 Information on the indicative construction programme is provided in Section 4.1 and the construction methodology is summarised in Volume 1, Introduction and methodology, Section 6. This illustrates how the phasing of activities at different compounds will generally be staggered and that construction activities at individual compounds may not occur over the whole duration presented in Table 11.

4.8.54 The assessment of the effects of construction of the Proposed Scheme on the highway network in the Carlisle Station area is based on the highest volume of construction traffic on each construction route during the construction period. Where construction routes will serve more than one construction compound, the assessment is based on the highest combined volume of construction traffic on each section of each route during the construction period.

Highway network

Strategic and local highway network

4.8.55 The primary HGV access routes for construction vehicles will be the strategic and/or primary road network with the use of the local road network limited, insofar as reasonably practicable. The construction routes will also provide access to compounds. In this area, it is proposed that the main construction routes will be:

- A6 Roman Road/Carleton Road/London Road/Botchergate;
- A69 Rotary Way/Warwick Road/Victoria Place;
- A7 Spencer Street/Georgian Way/Victoria Place/Lowther Street;
- A595 Bridge Street/Castle Way;
- Warwick Road;
- The Crescent;
- Devonshire Street;
- Victoria Viaduct;
- A595 Castle Way;
- B5299 Shaddongate;
- Junction Street;
- Currock Street;
- James Street;
- Robert Street;
- Charlotte Street;
- English Street;
- Nelson Bridge;
- Water Street;
- South George Street; and
- Crown Street.

4.8.56 Due to the limited scope of the works, the number of two-way vehicle movements to compounds is expected to be low during the local road network peak periods. The daily maximum flow is predicted to be 108 two-way vehicle movements to the South George Street main compound and 128 two-way vehicle movements to the High Wapping Sidings satellite compound. The majority of these vehicle movements will be worker trips or LGV movements and are expected to occur outside the local road network peak periods. The

daily maximum HGV flow is expected to be 20 two-way movements to the South George Street main compound and 20 two-way vehicle movements to the High Wapping Sidings satellite compound. This level of change in traffic levels will not result in adverse significant effects in relation to traffic severance for non-motorised users or in relation to traffic delays and congestion.

Accidents and safety

4.8.57 There will be no significant effects on accidents and safety as there will be no substantial increases in traffic during construction.

Parking and loading

4.8.58 The Proposed Scheme will have impacts on parking in the local area. This is likely to result in the temporary loss of 74 off-street parking spaces, including two blue badge spaces, at the Avanti Trains car park, accessed from South George Street. This construction activity will last for one year and nine months, resulting in a moderate adverse effect, which is significant.

4.8.59 HS2 Ltd will work with the businesses affected to identify opportunities where reasonably practicable to mitigate effects on parking.

Public transport network

4.8.60 Construction of the Proposed Scheme will not result in any significant effects upon the operation of existing bus services or stops.

4.8.61 There are interfaces with the existing rail network in this area, in particular on the operation of the WCML, the Cumbrian Coast Line and the Newcastle Line, and on the passengers and rail freight services using these lines.

4.8.62 The construction of the Proposed Scheme is expected to require a number of rail possessions and blockades over a period of up to one year and nine months in this area. This will include one possession of 27 hours, 11 possessions of 54 hours and one possession of 100 hours. One blockade of up to nine days will be required, comprising a full station closure, and a long-term possession of the northbound Cumbrian Coast Line and sidings 1, 2 and 3 will be required for up to one year. The works include the construction of platform 0, the installation of a new footbridge and the alterations of tracks.

4.8.63 Disruption to rail users will be reduced by limiting possessions, where reasonably practicable, to existing maintenance periods. Possessions and blockades will affect users of the WCML, the Cumbrian Coast Line and the Newcastle Line and will be managed through a combination of measures, which could include rail service diversions and replacement bus services, which will reduce the disruption to the travelling public.

4.8.64 Users of Carlisle Station, the Cumbrian Coast Line and the Newcastle Line will be affected by construction of the Proposed Scheme. During major possessions and blockades alternative transport options will be provided. Nonetheless, while individually these possessions are not considered significant, the possessions will occur intermittently over a period of one year

and six months and their cumulative impact is considered to have a major adverse effect, which is significant.

4.8.65 Since users of the WCML will be affected by possessions and blockades in the Carlisle Station area and community areas the effects of these are reported in Volume 3, Route-wide effects, Section 14.

4.8.66 HS2 Ltd will work with Network Rail and the train operating companies and freight operating companies to ensure that any need for additional possessions can be reduced with good planning and communication (including appropriate advance notice).

4.8.67 Passenger routes within Carlisle Station between platforms, concourse and surface connections and interchange will be affected throughout the construction period. The proposed phasing indicates that interchange routes and surface connections can be maintained with increases in travel distance of less than 100m. The proposed works to Carlisle Station are not forecast to result in significant effects to public transport users at the station as a result of changes to passenger routes.

Non-motorised users

4.8.68 The construction works associated with the Proposed Scheme will not require the temporary closure or diversion/realignment of any PRoW or roads in the vicinity of the Proposed Scheme.

Permanent effects

4.8.69 Any permanent effects of construction are considered in the assessment of operation for traffic and transport.

Other mitigation measures

4.8.70 The implementation of the measures in the draft CoCP, including travel plans, will help mitigate the transport-related effects during construction of the Proposed Scheme.

4.8.71 No further traffic and transport mitigation measures during construction of the Proposed Scheme are considered appropriate.

Summary of likely residual significant effects

4.8.72 Due to the limited scope of the works, the increases in traffic associated with the construction of the Proposed Scheme will not result in any significant effects on vehicle users or non-motorised users.

4.8.73 The construction of the Proposed Scheme will result in the temporary loss of 74 parking spaces at Avanti Trains car park accessed via South George Street (moderate adverse effect).

4.8.74 During the construction period, the cumulative impact of railway possessions is considered to have a major adverse significant effect on the operation of the Cumbrian Coast Line and the Newcastle Line and their passengers and rail freight services. Since the WCML will be

affected by possessions and blockades in the Carlisle Station area and other community areas the effects of these are reported in Volume 3, Route-wide effects, Section 14.

Cumulative effects

4.8.75 The assessment includes the cumulative effects of planned and committed development during construction by taking this into account within the background traffic growth.

4.8.76 The assessment also takes into account Proposed Scheme construction traffic and transport impacts of works to construct the Proposed Scheme being undertaken in neighbouring community areas.

Effects arising from operation

4.8.77 This section presents the likely significant environmental effects arising from the operation of the Proposed Scheme within the Carlisle Station area and improvements, alterations and adaptations to the existing Carlisle Station. The significant effects associated with changes in passenger numbers are considered in Section 5.

Avoidance and mitigation measures

4.8.78 The design of the works at Carlisle Station will avoid or reduce impacts on transport users through the following measures:

- enhanced facilities to accommodate HS2 services; and
- extension, widening and reinstatement of platforms, the provision of a new footbridge link, a new passenger lift and stairs to provide access to platform 0 via a subway created in an existing undercroft, maintaining capacity for non-HS2 users.

Assessment of impacts and effects

4.8.79 The following section considers the impacts on traffic and transport as a result of the improvements, alterations and adaptations to the existing Carlisle Station and the consequential effects resulting from the operational phase of the Proposed Scheme.

Key operation transport issues

4.8.80 The main impacts of the operation of the Proposed Scheme at Carlisle Station can be summarised as the modification of the Station to accommodate HS2 trains, which will provide direct and fast access and improved journey times from Carlisle to the Midlands and the south of England.

4.8.81 The Proposed Scheme will also result in changes in passenger demand and will require additional staff to operate from Carlisle Station, including drivers, managers, cleaners and customer services. The likely impacts arising from the associated changes in vehicle movements and parking demand at Carlisle Station, as a result of the operation of the Proposed Scheme, are considered in Section 5.

Public transport network

4.8.82 The design of the Proposed Scheme and its operation will result in substantially improved journey times between Carlisle Station, the Midlands and the south of England, as detailed in Volume 1, Introduction and methodology. This is a major beneficial effect, which is significant.

4.8.83 The proposed changes to the station layout are not expected to have a significant effect on existing station users as a result of any changes to physical linkage for the next stage of their journey or access to public transport. Access to all platforms will be provided via a new lift, connecting with the existing subway to maintain step-free access for persons with reduced mobility.

Other mitigation measures

4.8.84 No further traffic and transport mitigation measures are considered appropriate for the operation of the Proposed Scheme based on the outcome of the assessment.

Summary of likely residual significant effects

4.8.85 The Proposed Scheme will generate significant major beneficial effects for rail passengers as a result of the introduction of HS2 services at Carlisle Station, including improved journey times between Carlisle Station, the Midlands and the south of England and released capacity on the network easing pressure on other passenger rail services.

5 Off-route railway stations in operation

5.1 Introduction

5.1.1 This section of the report identifies the off-route railway stations across the conventional railway network where the operation of the Proposed Scheme, and the consequent release of capacity elsewhere, will result in changes to passenger numbers. HS2 Phase One stations are included within the assessment. These stations have been identified using the PLANET Framework Model[103] (PFM9.6), which identifies any changes in overall station footfall relating to the numbers of passengers entering/leaving a station. Any increase in passengers will lead to increases in the number of access journeys, including, potentially, by car, taxi, walking, cycle and bus. These increases do not necessarily require any physical works to the station or surrounding area. However, where any physical works are proposed to accommodate increased passenger numbers, the impacts of these works have been assessed and any likely significant effects reported in this volume of the ES.

5.2 Methodology

Traffic and transport methodology

5.2.1 Off-route railway stations on the conventional railway network, together with HS2 Phase One stations, may experience environmental effects where the operation of the Proposed Scheme, including the use of released capacity on the conventional railway network, results in increased passenger numbers at those stations. This section of the report explains how such stations are identified and assessed for the purposes of the EIA.

5.2.2 The off-route assessment for the Proposed Scheme follows the same approach as used for HS2 Phase One and Phase 2a. The assessment identifies off-route stations where an increase in passenger numbers is forecast to occur and assesses the potential for this to result in significant effects as a consequence of the Proposed Scheme, and of HS2 Phase One, Phase 2a and the Proposed Scheme combined.

5.2.3 Off-route stations identified for assessment include stations on the conventional rail network which will be subject to changes in passenger demand and that meet the criteria set out below, conventional rail stations served by HS2 trains and HS2 Phase One stations. Passenger demand at HS2 stations on the Proposed Scheme is covered in the Volume 2 assessments.

[103] The PLANET Framework Model (PFM) is a strategic transport model covering all long-distance rail movements across the UK and has been used to develop rail demand forecasts for HS2 Phase One, HS2 Phase 2a and the Proposed Scheme.

Criteria for environmental assessment

5.2.4 The identification of stations for assessment of off-route effects during operation is based upon the SMR criteria for traffic and transport impacts and takes into account the potential for air quality; community; socio-economic, sound, noise and vibration; and any other relevant environmental effects. The impacts that are a consequence of the Proposed Scheme in combination with HS2 Phase One and Phase 2a (referred to as the 'Proposed Scheme in combination' in this section) relate solely to changes in passenger numbers at these stations.

5.2.5 In terms of assessing traffic and transport impacts, the focus is primarily on changes to the number of cars and taxis accessing stations as a result of changes in rail passenger use derived from PFM, as this has a greater potential to give rise to significant environmental effects compared to bus use, walking and cycling. In particular, bus operators determine the frequency of bus services and can be expected to make adjustments to accommodate any changes in passenger demand when planning future services.

5.2.6 A two-stage process for identifying which off-route stations should be assessed was undertaken, based on the following criteria:

- an increase of 10% or more in the use of a station and its facilities and impacts on walking, cycling and public transport; and
- the potential impact on use of the road network, in particular congestion, and thresholds set in the context of the potential impacts on air quality and sound, noise and vibration.

5.2.7 The first stage of the assessment was to undertake a high level sift to establish which off-route stations would be impacted by the operation of the Proposed Scheme. The assessment considered change in passenger numbers and consequential transport impacts.

5.2.8 The SMR criteria identify a change in use of 10% or more (measured in this context in terms of railway station passenger footfall) as a threshold for when impacts on transport infrastructure, such as bus facilities, car and cycle parking provision or taxi usage, might become significant and when changes in traffic might affect pedestrian and cyclist severance. Below this level of change, it is not considered likely that there would be significant effects on transport infrastructure.

5.2.9 The assessment identifies the potential effects on traffic congestion and delays, taking into account the capacity of station access routes. A minimum change in likely highway use of 5% is applied and this has been factored up to an equivalent daily change in rail passengers. If a station is served by a busy urban single carriageway road, a threshold of a change of 700 users per day has been applied. For stations with higher capacity and dual carriageway road access, a higher threshold of 1,400 users per day has been used. Below these thresholds, the potential impact on transport facilities, congestion, air quality and sound, noise and vibration

would be negligible. These thresholds[104] assume a reasonable maximum percentage of passengers likely to arrive or depart by car or taxi and likely peak hour[105] passenger arrival and departure numbers. For those stations in large urban areas, such as Glasgow, with high mode share by public transport, these criteria have been adjusted to reflect the lower level of car/taxi access/egress and the consequential reduction in the impact of car-based access and egress to these stations.

5.2.10 If the thresholds for impacts on transport infrastructure and severance (a 10% change in use) or congestion (a change of 700 or 1,400 users per day depending on the type of road) are likely to be exceeded, further, more detailed analysis has been undertaken to determine whether the changes in use would be likely to result in significant effects. Below these thresholds, the potential impacts on transport facilities, congestion, air quality, sound, noise and vibration and community are considered to be negligible and not significant.

Forecast change in passenger demand

5.2.11 The operation of the Proposed Scheme, and the consequent release of capacity elsewhere, will result in changes to passenger numbers at off-route railway stations across the conventional railway network. This includes HS2 Phase One stations.

5.2.12 The forecast change in passengers as a result of HS2 Phase One, Phase 2a and the Proposed Scheme has been derived from PFM which has been periodically updated by HS2 Ltd during the course of the development of HS2. Consequently, different versions of the model have been used for the assessment of Phase One (PFM4.2), Phase 2a (PFM7.1) and the Proposed Scheme (PFM9.6). PFM9.6 has been used to identify changes in overall station footfall at off-route stations for the 2046 assessment year.

5.2.13 Changes to PFM made for this assessment include:

- inclusion of only Phase One, Phase 2a and the Proposed Scheme;
- revisions to proposed conventional railway and HS2 service patterns;
- updated forecasts of the growth in travel, building on the latest evidence of current patterns of rail travel (including updating the base model);
- changes to official forecasts for the growth of the UK economy and other drivers of transport demand. Continued growth in demand is forecast for long-distance rail travel to 2029-2033 when HS2 Phase One is scheduled to open, 2038 when the Proposed Scheme opens and beyond. However, the forecasts used in the assessment have been produced prior to the development of a full understanding of the likely impact of COVID-19 on economic growth and travel behaviour. The full impact of COVID-19 is not yet

[104] The 700 or 1,400 station users/day applied as the EIA screening criteria equate to a peak hour threshold trip generation of 75-95 or 150-190 vehicle movements respectively, for single and dual carriageway standard roads respectively.

[105] Peak hours for assessment are 08:00-09:00 for the morning peak and 17:00-18:00 for the evening peak hour.

known but is considered likely to result in lower travel demand in the medium term than the forecasts used in the assessment for background traffic and rail, including HS2; and

- updates to assumptions relating to committed transport investment.

5.2.14 Data from PFM have been used to obtain forecast changes in passenger demand at both HS2 and off-route stations as a result of the Proposed Scheme and for HS2 Phase One, Phase 2a and the Proposed Scheme combined. Changes in demand at stations served by HS2 trains are provided in Volume 3 of the ES.

5.2.15 The Phase One assessment for stations at London Euston, Old Oak Common, Birmingham Interchange and Birmingham Curzon Street also included an assessment of Phase 2b operations for the full Y network. However, the Phase One assessment was based on PFM4.2 forecasts for 2037 while the Proposed Scheme has been assessed using 2046 PFM9.6 forecasts. Checks were undertaken to ensure that the passenger demand forecasts at these stations had not changed materially between the different versions of PFM. As the Phase One assessment was based on the Full Y network serving both the Western and Eastern legs, the comparison with the Proposed Scheme demonstrates substantially lower footfall, approximately 37% for the London stations and 16% for the Birmingham stations. When the Phase One PFM4.2 forecasts were compared with a Full Y network run of PM9.6, the total flows between the two versions of PFM into and out of Birmingham and London were within 2%.

5.2.16 For these reasons, it was concluded that, as the demand used in the analysis undertaken for HS2 Phase One ES at the London and Birmingham HS2 stations[106] was substantially higher than that now used for the Proposed Scheme, any potential issues arising from increases in use of the stations due to HS2 were appropriately addressed by the Phase One assessment.

Sifting of stations

5.2.17 The criteria and demand forecasts described above have been used to identify stations where changes in passenger use arising from the Proposed Scheme in combination with HS2 Phase One and Phase 2a or the Proposed Scheme assuming Phases One and 2a are in operation, could give rise to effects on other transport networks. The sifting has been based on the PFM forecast of changes in passenger numbers at all stations across the conventional rail network.

5.2.18 Building upon the forecasts for use of each off-route station, traffic conditions at the off-route stations were established through site visits, traffic surveys and existing data from local authorities and Network Rail. Traffic surveys at the stations and on the local road networks were undertaken between March 2017 and July 2019 avoiding bank holidays and

[106] High Speed Two Ltd (2013), High Speed Rail (London-West Midlands), *Environmental Statement Volume 4: Off-route effects.* Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/259489/Volume_4_Off-route_effects.pdf.

school holidays. These surveys comprised junction turning counts, automatic traffic counts, car park and drop off surveys.

5.2.19 The changes in passenger use identified for the Proposed Scheme, HS2 Phase One and Phase 2a combined have also been compared with those assessed for HS2 Phase 2a and Phase One using earlier versions of PFM.

5.2.20 The stations where the predicted change in footfall meets the criteria of a daily increase in footfall of 10% or 700/1,400 users are set out in Table 13. This sets out both the in-combination change of Phase One, Phase 2a and the incremental change resulting from the Proposed Scheme assuming Phases One and 2a are in operation.

5.2.21 Six stations are forecast to experience an increase in daily passenger demand greater than 10% or 700/1,400 users as a consequence of the Proposed Scheme in combination with Phase One and 2a. Of these, only Carlisle experiences an incremental increase greater than 10% as a consequence of the Proposed Scheme in isolation with three further stations experiencing an increase in daily passenger demand greater than 700/1,400 users. Consequently, the six stations that experience an increase as a consequence of the Proposed Scheme in combination with Phase One and 2a have been considered further since the impacts are always greater than the incremental impacts of the Proposed Scheme.

Table 13: Increase in daily footfall at stations that meet the criteria for assessment of effects. Passengers/day, 2046. PFM9.6

Station	Change in daily passenger demand due to HS2 Phase One, Phase 2a and the Proposed Scheme together (2046)		Incremental change in daily passenger demand due to the Proposed Scheme (2046)	
	Change in footfall	% change	Change in footfall	% change
Milton Keynes Central	4,448	10%	1,005	3%
Crewe	2,554	10%	348	1%
Preston	3,518	16%	1,757	7%
Lancaster	1,276	15%	275	3%
Carlisle	1,682	20%	1,105	12%
Glasgow Central	4,854	6%	2,735	2%

5.2.22 There are a number of stations which are forecast to experience a reduction in footfall with the Proposed Scheme in combination with Phase One and 2a. These are shown in Table 14 along with the corresponding incremental change resulting from the Proposed Scheme.

Table 14: Reduction in daily footfall at stations. Passengers/day, 2046

Station	Change in daily passenger demand due to HS2 Phase One, Phase 2a and the Proposed Scheme together (2046)		Incremental change in daily passenger demand due to the Proposed Scheme (2046)	
	Change in footfall	% change	Change in footfall	% change
London Paddington	-124,515	-50%	1,323	1%
London Kings Cross	-6,719	-7%	<500	<5%
London Marylebone	-7,095	-11%	-493	-1%

Station	Change in daily passenger demand due to HS2 Phase One, Phase 2a and the Proposed Scheme together (2046)		Incremental change in daily passenger demand due to the Proposed Scheme (2046)	
Coventry	-4,215	-11%	1,265	3%
Nuneaton	-847	-8%	362	4%
Birmingham International	-7,356	-20%	989	3%
Birmingham New Street	-19,172	-11%	-4,426	-3%
Lichfield Trent Valley	-751	-6%	<500	<5%
Warrington Bank Quay	-794	-9%	-1,307	-14%
Manchester Airport	-1,382	-7%	<500	<5%
Stockport	-7,503	-14%	<500	<5%

5.2.23 Eleven stations are forecast to experience a decrease in daily passenger demand greater than 10% or 700/1,400 users due to the Proposed Scheme in combination with Phase One and 2a, with cumulative reductions up to 50%. These stations are generally directly impacted by alternative faster HS2 services. Consequently, it is expected that a number of passengers would use a Proposed Scheme station to divert to more convenient, faster Proposed Scheme services. This will have the benefit of releasing capacity on the existing rail network, as well as on the traffic and transport network local to the off-route stations. Those stations which experience either an increase in footfall or a decrease in footfall of less than 500 trips or 5% as a result of the incremental impact of the Proposed Scheme are stations where the majority of the impact is a result of other phases of HS2 rather than the Proposed Scheme.

5.2.24 The largest changes in passenger demand due to the Proposed Scheme in combination with HS2 Phase One and Phase 2a are at London and Birmingham stations, most notably London Paddington and Birmingham New Street stations. For Paddington, the reduction is a result of HS2 Phase One with the introduction of interchange at Old Oak Common between the Great Western Main Line (GWML) fast services, Crossrail and HS2 services. In effect, these are passengers who in the future baseline would have interchanged between GWML (fast) services and Crossrail at Paddington. However, with HS2 Phase One, these passengers make the same interchange at Old Oak Common. The reductions at Birmingham New Street Station reflect the proximity to the HS2 station at Birmingham Curzon Street. There are smaller reductions in demand as a result of the Proposed Scheme in combination with HS2 Phase One and Phase 2a at London Kings Cross and Marylebone and Birmingham International stations reflecting diversion to HS2 services at adjacent HS2 stations.

Sound, noise and vibration assessment methodology

5.2.25 The predicted traffic flows at each station, arising from the Proposed Scheme in combination with existing traffic flows, were assessed to identify where changes in basic noise level[107] will exceed thresholds identified in the assessment methodology[108]. This is consistent with the approach defined in the Design Manual for Roads and Bridges (DMRB)[109] where assessment threshold is exceeded and assessment of sound has been undertaken. The main criterion adopted for this assessment was to examine where annual average weekday traffic (AAWT) flows increase by more than 20%, where the flow is greater than 1,000 vehicles per day[110]. Roads were examined to identify where traffic flows are predicted to increase by more than this threshold. Below this threshold, adverse effects were considered to be negligible and not significant.

5.2.26 Where the threshold was exceeded, the change in base noise levels[111] was calculated to establish whether an increase of 3dB or greater could occur at receptors along each road considered. A 3dB change would result in a minor long-term adverse effect on residential receptors, which is not considered to be significant. No 3dB or greater changes were identified.

5.2.27 The assessment was carried out for the year 2038 which is the year of opening of the Proposed Scheme, using the predicted traffic flows for 2046. This is a reasonable worst-case approach. Changes in car technology may offset some of the expected sound level increases due to traffic growth expected without the Proposed Scheme on low speed roads. On higher speed roads[112] tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Air quality assessment methodology

5.2.28 In order to identify where a detailed air quality assessment was required the predicted traffic flows at each station, arising from the Proposed Scheme in combination, were examined to identify where changes exceeded the thresholds detailed in the SMR. The main criteria adopted for this assessment were used to examine where annual average daily

[107] As defined in Department for Transport memorandum, Calculation of Road Traffic Noise (1988).

[108] Further information is provided in Volume 5: Appendix SV-001-00000, *Sound, noise and vibration methodology, assumptions and assessment*.

[109] Highways Agency (2011), *The Design Manual for Roads and Bridges (Volume 11, Section 3, Part 7 Noise and Vibration* HD213/11. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/hd21311.pdf.

[110] This corresponds to the lower extent of the validated range of the Calculation of Road Traffic Noise prediction methodology.

[111] Her Majesty's Stationery Office (1988), *Calculation of Road Traffic Noise*.

[112] Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

traffic (AADT) flows would increase by more than 1,000 vehicles. These criteria were not exceeded for any of the off-route stations and it has therefore been concluded that the air quality impacts will be negligible.

5.2.29 The assessment was carried out for the predicted traffic flows in 2038. This is a reasonable worst-case approach as pollutant concentrations are expected to decrease in future years as vehicle emissions standards improve.

5.3 Changes in demand at off-route stations during operation

5.3.1 This section reports the assessment undertaken for the six off-route railway stations (Milton Keynes Central, Crewe, Preston, Lancaster, Carlisle and Glasgow Central) where there is potential for significant effects, due to an increase in passenger numbers as a result of the Proposed Scheme or due to the Proposed Scheme in combination with HS2 Phase One and Phase 2a.

5.3.2 Existing conditions at the off-route stations that met the sift criteria were established through site visits, traffic surveys and data from local authorities and Network Rail. The traffic surveys were undertaken in May, June and early July 2019, avoiding bank holidays and school holidays, with the exception of Preston and Crewe which used existing 2017 survey data. The surveys comprised:

- junction turning counts;
- automatic traffic counts;
- car park demand surveys; and
- taxi drop-off/pick-up surveys.

5.3.3 For the purpose of the highway assessment, the highway peak hours were taken as 08:00-09:00 and 17:00-18:00.

5.3.4 The existing vehicular trip generation at each off-route station was established from the traffic surveys. The future baseline for the 2046 assessment year was then estimated by applying growth in line with the DfT Trip End Model Presentation Program (TEMPro).

5.3.5 The percentage growth in station use with the Proposed Scheme in combination was then established using the forecast percentage increase in passengers from PFM between the 2046 future baseline and the Proposed Scheme in combination, with mode share in the future assumed to remain the same as the existing mode share.

5.3.6 The effects on the local road network were established using the following process:

- the HS2 Phase One, Phase 2a and the Proposed Scheme trips were distributed onto the road network based on the existing turning movements/proportions recorded in the station traffic surveys;

- the trips generated by HS2 Phase One, Phase 2a and the Proposed Scheme were added to the 2046 future baseline traffic flows to establish 2046 'with the Proposed Scheme' traffic flows; and
- a comparison of the future baseline and 'with the Proposed Scheme' traffic flows was carried out to establish whether the cumulative impact of HS2 Phase One/2a and the Proposed Scheme or the Proposed Scheme assuming Phases One and 2a are in operation would result in any significant effects on the local road network.

5.3.7 For walk cycle and bus, the assessment is based upon the assumption that the change in use will be pro rata to the change in overall use of the station.

Milton Keynes Central Station

Introduction

5.3.8 The introduction of HS2 services and the use of resulting released capacity on the conventional network will provide potential for service improvements and reduced crowding on trains for passengers who use Milton Keynes Central Station, which is expected to result in increased passenger demand. It is forecast that by 2046, passenger demand at Milton Keynes Central Station will increase by approximately 10%, equivalent to 4,450 additional passengers per day as a result of the Proposed Scheme in combination with Phase One and 2a.

Changes in highway use

Environmental baseline

5.3.9 Milton Keynes Central Station is located on Elder Gate, at the western end of central Milton Keynes. To the west of the station, the rail line runs parallel with the A5 road.

5.3.10 Milton Keynes is built on a grid system. Elder Gate is a wide single carriageway road running broadly north-west to south-east. Parallel to Elder Gate to the east is V6 Grafton Street which is a wide, three-lane dual carriageway. Perpendicular to Elder Gate and V6 Grafton Street are Silbury Boulevard, Midsummer Boulevard and Avebury Boulevard. Footway access to the station is via segregated pedestrian underpasses which separate vehicular traffic on the main roads from pedestrians.

5.3.11 Vehicular access to Milton Keynes Central Station is via Elder Gate. There is extensive long and short-stay parking close to the station and within Milton Keynes town centre. A series of dual carriageway boulevards provide access to the station from the A509, the A5 and other routes. As a result, the higher threshold of 1,400 users per day has initially been applied. However, given the alternative high-capacity routes available, it is considered that a much higher overall level of traffic could be accommodated without material impact on congestion. In addition, there is a bus interchange at the station, and with a substantial

proportion of the increased usage forecast to be local trips, it is expected that there will be a substantial use of public transport use for accessing the station.

5.3.12 The car park and drop off surveys undertaken in May 2019 recorded 1,485 vehicle movements to/from the station in the morning peak hour, and 1,611 in the evening peak hour.

5.3.13 Future baseline traffic volumes are forecast to grow by around 25% in the morning peak hour and 24% in the evening peak hour by 2046 compared to 2019. As a result, in the future baseline of 2046, it is predicted that the station will attract 1,860 vehicle movements in the morning peak hour and 2,000 in the evening peak hour.

Overview of environmental effects

Traffic and transport

5.3.14 It is predicted that in 2046, the Proposed Scheme in combination with HS2 Phase One and Phase 2a will generate an additional 191 vehicular trips in the morning peak hour and an additional 205 trips in the evening peak hour. When these trips are distributed to the network, it is predicted that the highest level of impact will occur on Elder Gate between Midsummer Boulevard and Avebury Boulevard, where it is predicted that the Proposed Scheme in combination will generate an additional 75 vehicular trips in the morning peak hour and an additional 69 trips in the evening peak hour. This is outside the range considered to have the potential to result in significant effects on traffic congestion and delays (150-190 trips for a dual carriageway road).

5.3.15 There may be an increase in parking demand and use of drop-off facilities as a result of the increased passenger numbers using the station. The increased pressure on parking and drop-off facilities has been assessed as having a minor adverse significant effect. The station owner/operator and the local highway authorities may need to give consideration as to any measures to address any shortfall in parking.

5.3.16 There will also be the potential for a minor adverse significant effect on cycle parking provision but it is not considered that the increase in demand would have a potential adverse effect on walk routes or bus facilities. Bus operators determine the frequency of bus services and can be expected to make adjustments to accommodate any changes in passenger demand when planning future services.

5.3.17 The peak hour generation on Avebury Boulevard west of South Elder Roundabout is predicted to result in an increase of around 10% in the two-way traffic flow in the morning peak period and the evening peak period. This falls into the low impact criteria as set out in the operation section of the SMR for traffic-related severance for vulnerable road users (increase in peak hour flow of 10% to 20%). As Avebury Boulevard is a dual carriageway with limited frontage activities and a pedestrian underpass west of its junction with V6 Grafton Way, it has been assessed as a minor adverse effect on traffic-related severance for vulnerable road users, which is significant.

Sound, noise and vibration

5.3.18 The minimum change in AAWT road traffic flow that could potentially result in an adverse noise effect is a 20% increase. The highest forecast change in traffic on roads around the station is 12%, which is below this threshold and is not significant.

Air quality

5.3.19 The largest predicted increase in traffic flows is on Elder Gate between Midsummer Boulevard and Avebury Boulevard where AADT flows are predicted to increase by up to 917 vehicles over the baseline AADT flow of 13,337 in 2038. Elsewhere, on roads around the station, the predicted increases in traffic flows are lower. The predicted changes in traffic flows are below the threshold where a significant air quality effect is likely to occur.

Mitigation measures

5.3.20 No further mitigation measures are considered necessary during operation of the Proposed Scheme based on the outcome of this assessment.

Summary of likely residual significant effects

5.3.21 The forecast increase in daily passengers due to the Proposed Scheme in combination with HS2 Phase One and Phase 2a will result in an increase in traffic flow on Avebury Boulevard west of South Elder Roundabout, leading to minor adverse significant effects on traffic and transport in terms of traffic-related severance. The increased use will result in minor adverse significant effects on car parking facilities. There will also be potential for a minor adverse significant effect of cycle parking. No residual significant effects for sound, noise and vibration or air quality have been identified as a result of the operation of the Proposed Scheme.

Crewe Station

Introduction

5.3.22 The introduction of HS2 services calling at Crewe Station is expected to result in increased passenger demand entering and leaving the station. It is forecast that by 2046, passenger demand at Crewe Station will increase by approximately 10%, equivalent to 2,554 additional passengers per day, as a result of the Proposed Scheme in combination with Phase One and 2a.

Changes in highway use

Environmental baseline

5.3.23 Crewe Station is located on Nantwich Road, approximately 1km south of Crewe town centre. The station is bordered by Nantwich Road to the north, Weston Road to the east, and rail lines to the west and south. The rail corridor runs north to south.

5.3.24 Vehicular access to Crewe Station is on Nantwich road where the station frontage provides a pick-up and drop-off area for cars and taxis, and two parking bays for disabled rail users. There is no formal taxi rank at the station frontage. The nearest bus stops are located outside the station frontage on Nantwich Road. A short stay car park is located on Pedley Street, while long stay car parks are located on Pedley Street and Weston Road.

5.3.25 The car park and drop off surveys undertaken in June 2017 recorded 304 vehicle movements to/from the station in the morning peak hour, and 360 in the evening peak hour.

5.3.26 Future baseline traffic volumes are forecast to grow by around 17% in the morning peak hour and 16% in the evening peak hour by 2046 compared to 2017. As a result, in the future baseline of 2046, it is predicted that the station will attract 356 vehicle movements in the morning peak hour and 418 in the evening peak hour.

Overview of environmental effects

Traffic and transport

5.3.27 It is predicted that in 2046, the Proposed Scheme in combination with HS2 Phase One and Phase 2a will generate an additional 36 vehicular trips in the morning peak hour and an additional 42 trips in the evening peak hour at Crewe Station. This is outside the range considered to have the potential to result in significant effects (75-95 trips for a single carriageway road).

5.3.28 There may be an increase in parking demand and use of drop-off facilities as a result of the increased passenger numbers using the station. The increased pressure on parking and drop-off facilities has been assessed as having a minor adverse significant effect. The station owner/operator and the local highway authorities may need to give consideration as to any measures to address any shortfall in parking.

5.3.29 There will also be the potential for a minor adverse significant effect on cycle parking provision but it is not considered that the increase in demand would have a potential adverse effect on walk routes or bus facilities. Bus operators determine the frequency of bus services and can be expected to make adjustments to accommodate any changes in passenger demand when planning future services.

5.3.30 The peak hour generation on Pedley Street is predicted to result in an increase of 3.5% in the two-way traffic flow in the morning peak period and 1.1% in the evening peak period. The

peak hour flow increases on this link are below the level considered to have the potential to result in significant traffic-related severance effects for vulnerable road users.

5.3.31 These results indicate that no significant effects on traffic and transport are likely to arise from the Proposed Scheme in combination, and no further analysis is considered necessary.

Sound, noise and vibration

5.3.32 The minimum change in AAWT road traffic flow that could potentially result in an adverse noise effect is a 20% increase. The highest forecast change in traffic on roads around the station is 2%, which is below this threshold and is not significant.

Air quality

5.3.33 The largest predicted increase in traffic flows is on the A534 Nantwich Road where AADT flows are predicted to increase by up to 232 vehicles over the baseline AADT flow of 27,122 in 2038. Elsewhere, on roads around the station, the predicted increases in traffic flows are lower. The predicted changes in traffic flows are well below the threshold where a significant air quality effect is likely to occur.

Mitigation measures

5.3.34 No further mitigation measures are considered necessary during operation of the Proposed Scheme based on the outcome of this assessment.

Summary of likely residual significant effects

5.3.35 The forecast increase in daily passengers due to the Proposed Scheme in combination with HS2 Phase One and Phase 2a will result in a minor adverse significant effect on traffic and transport in terms of car parking and drop-off facilities. There will also be potential for a minor adverse significant effect of cycle parking. No residual significant effects on air quality or sound, noise and vibration have been identified as a result of the operation of the Proposed Scheme.

Preston Station

Introduction

5.3.36 The introduction of HS2 services calling at Preston Station is expected to result in increased passenger demand entering and leaving the station. It is forecast that by 2046, passenger demand at Preston Station will increase by approximately 16%, equivalent to 3,518 additional passengers per day, as a result of the Proposed Scheme in combination with Phase One and 2a.

Changes in highway use

Environmental baseline

5.3.37 Preston Station is situated within Preston city centre, south of the A59 Ring Way, west of Butler Street and east of Christian Road and West Cliff. The station car park, Fishergate Shopping Centre and the shopping centre car park are immediately adjacent to Preston Station to the east and there are depots operated by Network Rail and Royal Mail Group to the west.

5.3.38 Vehicular access to Preston Station is off Fishergate and Butler Street. Fishergate provides access to car and taxi pick up/drop off facilities. Butler Street provides access to the short stay car park, with a one-way loop at the station frontage, and also the main station car park. Butler Street is accessed off Fishergate and Corporation Street via an underpass (entry only). Corporation Street provides the link between Fishergate and the A59 Ring Way to the north. Fishergate connects to the A5072 Strand Road, Liverpool Road and Broadgate to the west, and to the east of Corporation Street is one way westbound.

5.3.39 Due to availability of data, surveys undertaken in March 2017 were utilised for Preston. The car park and drop off surveys recorded 307 vehicle movements to/from the station in the morning peak hour, and 412 in the evening peak hour.

5.3.40 Future baseline traffic volumes are forecast to grow by around 20% in the morning peak hour and 18% in the evening peak hour by 2046 compared to 2017. In the future baseline of 2046, it is forecast that the station will attract 368 vehicle movements in the morning peak hour and 487 in the evening peak hour.

Overview of environmental effects

Traffic and transport

5.3.41 It is predicted that in 2046 the Proposed Scheme in combination with HS2 Phase One and Phase 2a will generate 57 additional vehicular trips in the morning peak hour and 75 additional trips in the evening peak hour at Preston Station. For the morning peak hour, this is at the lower level of the range considered to have the potential to result in significant effects on traffic congestion and delays (75-95 trips for a single carriageway road). However, Preston Station is accessed via two roads; Fishergate provides access to car and taxi pick up/drop off facilities with Butler Street providing access to the short stay car park, with a one-way loop outside the entrance, and also the main station car park. For Preston, the 75 vehicle/hour threshold, related to a highway capacity of 1,500 vehicles/hour therefore considerably underestimates the actual road capacity accessing the station. For this reason, the additional 75 trips generated by the Proposed Scheme in the evening peak hour is considered to be below the level which would have the potential to result in significant effects on traffic congestion and delays.

5.3.42 In addition to increased demand associated with passengers, there will be a requirement for 123 daily operation staff including drivers, managers, cleaners and customer service staff at Preston Station. However, these jobs will be arranged across four shifts and the consequential impact on the highway network during peak hours is expected to be negligible.

5.3.43 The peak hour generation on Fishergate Hill between Preston Station and Butler Street is predicted to result in an increase of 7.8% in the two-way traffic flow in the morning peak period and 4.6% in the evening peak period. The peak hour flow increase on this link is below the level considered to have the potential to result in significant traffic-related severance effects.

5.3.44 There may be an increase in parking demand and use of drop-off facilities as a result of a combination of increased passenger demand and operational staff at Preston Station with the potential for insufficient car parking available for all users. This has been assessed as having a moderate adverse effect which is significant. The station owner/operator and the local highway authorities may need to give consideration as to any measures to address any shortfall in parking.

5.3.45 There will also be the potential for a minor adverse significant effect on cycle parking provision but it is not considered that the increase in demand would have a potential adverse effect on walk routes or bus facilities. Bus operators determine the frequency of bus services and can be expected to make adjustments to accommodate any changes in passenger demand when planning future services.

Sound, noise and vibration

5.3.46 The minimum change in AAWT road traffic flow that could potentially result in an adverse noise effect is a 20% increase. The highest forecast change in traffic on roads around the station is around 16%[113] which is below this threshold and is not significant.

Air quality

5.3.47 The largest predicted increase in traffic flows is on Fishergate Hill between the station and Butler Street where AADT flows are predicted to increase by up to 513 vehicles over the baseline AADT flow of 9,833 in 2038. Elsewhere, on roads around the station, the predicted increases in traffic flows are lower. The predicted changes in traffic flows are well below the threshold where a significant air quality effect is likely to occur.

Mitigation measures

5.3.48 No further mitigation measures are considered necessary during operation of the Proposed Scheme based on the outcome of this assessment.

[113] This change is predicted on the connector link to multi-storey car park from the shopping centre. All other routes are subject to changes of less than 6%.

Summary of likely residual significant effects

5.3.49 The forecast increase in daily passengers due to the Proposed Scheme in combination with HS2 Phase One and Phase 2a will result in a moderate adverse significant effect on traffic and transport in terms of car parking and drop-off facilities. There will also be potential for a minor adverse significant effect on cycle parking. No residual significant effects for sound, noise and vibration or air quality have been identified as a result of the operation of the Proposed Scheme.

Lancaster Station

Introduction

5.3.50 The introduction of HS2 services calling at Lancaster Station is expected to result in increased passenger demand entering and leaving the station. It is forecast that by 2046, passenger demand at Lancaster Station will increase by approximately 15%, equivalent to 1,276 additional passengers per day, as a result of the Proposed Scheme in combination with Phase One and 2a.

Changes in highway use

Environmental baseline

5.3.51 Lancaster Station is located on Station Road, approximately 250m west of Lancaster city centre. The station is bordered by Station Road to the west, Westbourne Road to the south, and West Road cycle route to the north. To the east of the station, is the Lancaster Quaker Meeting House and a residential development on Castle Park Mews. The rail corridor runs north to south at a low level relative to the surrounding areas.

5.3.52 Vehicular access to Lancaster Station is on Station Road to the western side of the station, and via Westbourne Road to the eastern side. Both sides provide pick-up and drop-off facilities for cars and taxis, short stay parking for all users and dedicated spaces for disabled badge holders. A long-stay car park is located south of Westbourne Road, close to Station Road. Bus stops for the station are located on Westbourne Road and at the western entrance on Station Road.

5.3.53 The car park and drop off surveys undertaken in July 2019 recorded 304 vehicle movements to/from the station in the morning peak hour, and 281 in the evening peak hour.

5.3.54 Future baseline traffic volumes are forecast to grow by around 19% in the morning peak hour and 14% in the evening peak hour by 2046 compared to 2019. As a result, in the future baseline of 2046, it is predicted that the station will attract 413 vehicle movements in the morning peak hour and 372 in the evening peak hour.

Overview of environmental effects

Traffic and transport

5.3.55 It is predicted that in 2046 the Proposed Scheme in combination with HS2 Phase One and Phase 2a will generate an additional 53 vehicular trips in the morning peak hour and an additional 47 trips in the evening peak hour at Lancaster Station. This is outside the range considered to have the potential to result in significant effects (75-95 trips for a single carriageway road).

5.3.56 The peak hour generation on Meeting House Lane west of Castle Hill is predicted to result in an increase of 1.5% in the two-way traffic flow in the morning peak period and 1.4% in the evening peak period. The peak hour flow increase on this link is below the level considered to have the potential to result in significant traffic-related severance effects.

5.3.57 There may be an increase in parking demand and use of drop-off facilities as a result of the increased passenger numbers using the station. The increased pressure on parking and drop-off facilities has been assessed as having a minor adverse significant effect. The station owner/operator and the local highway authorities may need to give consideration as to any measures to address any shortfall in parking.

5.3.58 There will also be the potential for a minor adverse significant effect on cycle parking provision but it is not considered that the increase in demand would have a potential adverse effect on walk routes or bus facilities. Bus operators determine the frequency of bus services and can be expected to make adjustments to accommodate any changes in passenger demand when planning future services.

Sound, noise and vibration

5.3.59 The minimum change in AAWT road traffic flow that could potentially result in an adverse noise effect is a 20% increase. The highest forecast change in traffic on roads around the station is 4%, which is below this threshold and is not significant.

Air quality

5.3.60 The largest predicted increase in traffic flows is on Westbourne Road where AADT flows are predicted to increase by up to 367 vehicles over the baseline AADT flow of 13,084 in 2038. Elsewhere, on roads around the station, the predicted increases in traffic flows are lower. The predicted changes in traffic flows are well below the threshold where a significant air quality effect is likely to occur.

Mitigation measures

5.3.61 No further mitigation measures are considered necessary during operation of the Proposed Scheme based on the outcome of this assessment.

Summary of likely residual significant effects

5.3.62 The forecast increase in daily passengers due to the Proposed Scheme will result in a minor adverse significant effect on traffic and transport in terms of parking and drop-off facilities. There will also be potential for a minor adverse significant effect of cycle parking. No residual significant effects for sound, noise and vibration or air quality have been identified as a result of the operation of the Proposed Scheme.

Carlisle Station

Introduction

5.3.63 The introduction of HS2 services calling at Carlisle Station is expected to result in increased passenger demand entering and leaving the station. It is forecast that by 2046, passenger demand at Carlisle Station will increase by approximately 20%, equivalent to 1,682 additional passengers per day, as a result of the Proposed Scheme in combination with Phase One and 2a.

Changes in highway use

Environmental baseline

5.3.64 Carlisle Station is located to the south-western edge of the city centre. The station is bordered by Borough Street and Court Square Brow to the north, Collier Lane and Crown Street to the east and Victoria Viaduct to the west. The rail corridor runs north-west to south east forming the southern edge of the station.

5.3.65 Vehicular access to Carlisle Station is at Court Square Brow, which provides a drop off area and several parking bays for the station operators and disabled rail users. There is no formal taxi rank at the station frontage. The nearest bus stops to the station are located on English Street. A short stay car park is located at Court Square, while the station is served by two long stay car parks located at the station and at the Victoria Viaduct Estate. Court Square Brow connects with English Street, which forms part of the gyratory road network within Carlisle town centre.

5.3.66 The car park and drop off surveys undertaken in July 2019 recorded 302 vehicle movements to/from the station in the morning peak hour, and 289 in the evening peak hour.

5.3.67 Future baseline traffic volumes are forecast to grow by around 17% in both the morning and evening peak hours by 2046 compared to 2019. As a result, in the future baseline of 2046, it is predicted that the station will attract 354 vehicle movements in the morning peak hour and 337 in the evening peak hour.

Overview of environmental effects

Traffic and transport

5.3.68 It is predicted that in 2046 the Proposed Scheme in combination will generate an additional 69 vehicular trips in the morning peak hour and an additional 66 trips in the evening peak hour at Carlisle Station. This is outside the range considered to have the potential to result in significant effects (75-95 trips for a single carriageway road).

5.3.69 In addition to increased demand associated with passengers, there will be a requirement for 163 daily operation staff including drivers, managers, cleaners and customer service staff at Carlisle Station. However, these jobs will be arranged across four shifts and the consequential impact on the highway network during peak hours is expected to be negligible.

5.3.70 The peak hour generation on Court Square Brow is predicted to result in an increase of 19% in the two-way morning peak hour traffic flow and 16% in the two-way evening peak hour traffic flow. This falls into the low impact criteria for the morning and evening peak hours for traffic-related severance for vulnerable road users. However, the low two-way flow (305 and 347 vehicles in the morning and evening peak hours respectively), the relatively low increase in flow resulting from the Proposed Scheme (55 and 49 vehicles in the morning and evening peak hours) and the presence of safe pedestrian crossing facilities at the junction of Court Square Brow and English Street means that this has been assessed as a minor adverse effect for traffic-related severance, which is significant.

5.3.71 There may be an increase in parking demand and use of drop-off facilities as a result of a combination of increased passenger demand and operational staff at Carlisle Station with the potential for insufficient car parking available for all users. This has been assessed as having a moderate adverse effect which is significant. The station owner/operator and the local highway authorities may need to give consideration as to any measures to address any shortfall in parking.

5.3.72 There will also be the potential for a minor adverse significant effect on cycle parking provision but it is not considered that the increase in demand would have a potential adverse effect on walk routes or bus facilities. Bus operators determine the frequency of bus services and can be expected to make adjustments to accommodate any changes in passenger demand when planning future services.

Sound, noise and vibration

5.3.73 The minimum change in AAWT road traffic flow that could potentially result in an adverse noise effect is a 20% increase[114]. The forecast change on Court Square Brow is at this threshold. The change in basic noise levels has been calculated for this road, and the

[114] All other route subject to changes of less than 6%.

increase is predicted at less than 1.5dB. This adverse effect is considered to be negligible and not significant.

Air quality

5.3.74 The largest predicted increase in traffic flows is on Court Square Brow where AADT flows are predicted to increase by up to 747 vehicles over the baseline AADT flow of 4,013 in 2038. Elsewhere, on roads around the station, the predicted increases in traffic flows are lower. The predicted changes in traffic flows are below the threshold where a significant air quality effect is likely to occur.

Mitigation measures

5.3.75 No further mitigation measures are considered necessary during operation of the Proposed Scheme based on the outcome of this assessment.

Summary of likely residual significant effects

5.3.76 The forecast increase in daily passengers due to the Proposed Scheme will result in a minor adverse significant effect on traffic and transport in terms of traffic-related severance and a moderate adverse significant effect on parking and drop-off facilities. There will also be potential for a minor adverse significant effect of cycle parking. No residual significant effects for sound, noise and vibration or air quality have been identified as a result of the operation of the Proposed Scheme.

Glasgow Central Station

Introduction

5.3.77 The introduction of HS2 services calling at Glasgow Central Station is expected to result in increased passenger demand entering and leaving the station. It is forecast that by 2046, passenger demand at Glasgow Station will increase by approximately 6%, equivalent to 4,854 additional passengers per day, as a result of the Proposed Scheme in combination with Phase One and 2a.

Changes in highway use

Environmental baseline

5.3.78 Glasgow Central Station is located within Glasgow city centre. The station is bordered by Hope Street to the west, Gordon Street to the north, Union Street to the east and Broomielaw to the south. Midland Street and Argyle Street pass under the station, which is at an elevated level.

5.3.79 The primary access location for vehicle pick-up and drop-off at the station is on Gordon Street, which provides a taxi rank and drop-off area for around four vehicles. There are

further taxi ranks on Union Street and Hope Street close to station access points. There are bus stops serving the station on Hope Street, Union Street and Argyle Street. There is no dedicated long-stay or short-stay associated with the station. However, there are a large number of short-stay car parking spaces available on-street and within commercial car parks in Glasgow city centre.

5.3.80 The pick-up and drop-off surveys undertaken in May 2019 recorded 273 vehicle movements to/from the station in the morning peak hour, and 279 in the evening peak hour.

5.3.81 Future baseline traffic volumes are forecast to grow by around 24% in the morning peak hour and 18% in the evening peak hour by 2046 compared to 2019. As a result, in the future baseline of 2046, it is predicted that the station will attract 338 vehicle movements in the morning peak hour and 331 in the evening peak hour.

Overview of environmental effects

Traffic and transport

5.3.82 It is predicted that in 2046 the Proposed Scheme in combination will generate an additional 20 vehicular trips in both the morning and evening peak hours at Glasgow Central Station. This is outside the range considered to have the potential to result in significant effects (75-95 trips for a single carriageway road). The increase in vehicles is less than 10% so is considered not to have an impact on the highway network.

5.3.83 The peak hour generation on Gordon Street is predicted to result in an increase of 5% in the two-way traffic flow in the morning peak period and 4% in the evening peak period. The peak hour flow increases on this link are below the level considered to have the potential to result in significant traffic-related severance effects for vulnerable road users.

5.3.84 The overall change in use of the station of 6% is not at a level that would be likely to result in impacts on other station facilities, including cycle parking, the local walk network or local bus services.

5.3.85 These results indicate that no significant effects on traffic and transport are likely to arise from the Proposed Scheme in combination.

Sound, noise and vibration

5.3.86 The minimum change in AAWT road traffic flow that could potentially result in an adverse noise effect is a 20% increase. The highest forecast change in traffic on roads around the station is 4%, which is below this threshold and is not significant.

Air quality

5.3.87 The largest predicted increase in traffic flows is on Gordon Street between Hope Street and Union Street where AADT flows are predicted to increase by up to 148 vehicles over the baseline AADT flow of 3,218 in 2038. Elsewhere, on roads around the station, the predicted

increases in traffic flows are lower. The predicted changes in traffic flows are well below the threshold where a significant air quality effect is likely to occur.

Mitigation measures

5.3.88 No further mitigation measures are considered necessary during operation of the Proposed Scheme based on the outcome of this assessment.

Summary of likely residual significant effects

5.3.89 No residual significant effects on traffic and transport, air quality or sound, noise and vibration have been identified as a result of the operation of the Proposed Scheme.

6 Annandale depot

6.1 Overview of the area and description of the Proposed Scheme

Overview of the area

General

6.1.1 The Proposed Scheme in the Annandale area (between Gretna Green and Kirkpatrick-Fleming) will comprise three main components:

- Annandale depot, which will provide stabling and light maintenance facilities and accommodate up to 28 200m HS2 trains that will serve destinations on the HS2 network and the West Coast Main Line (WCML), including Carlisle, Glasgow and Edinburgh;
- reception tracks connecting Annandale depot to the existing WCML; and
- modifications to the WCML, to enable access to Annandale depot.

6.1.2 The Proposed Scheme in the Annandale area will lie within the Dumfries and Galloway Council (DGC) administrative area and will be located north of the B7076 and off the existing WCML, approximately 3km north-west of Gretna Green and approximately 2km south-east of Kirkpatrick-Fleming, as shown on Figure 12.

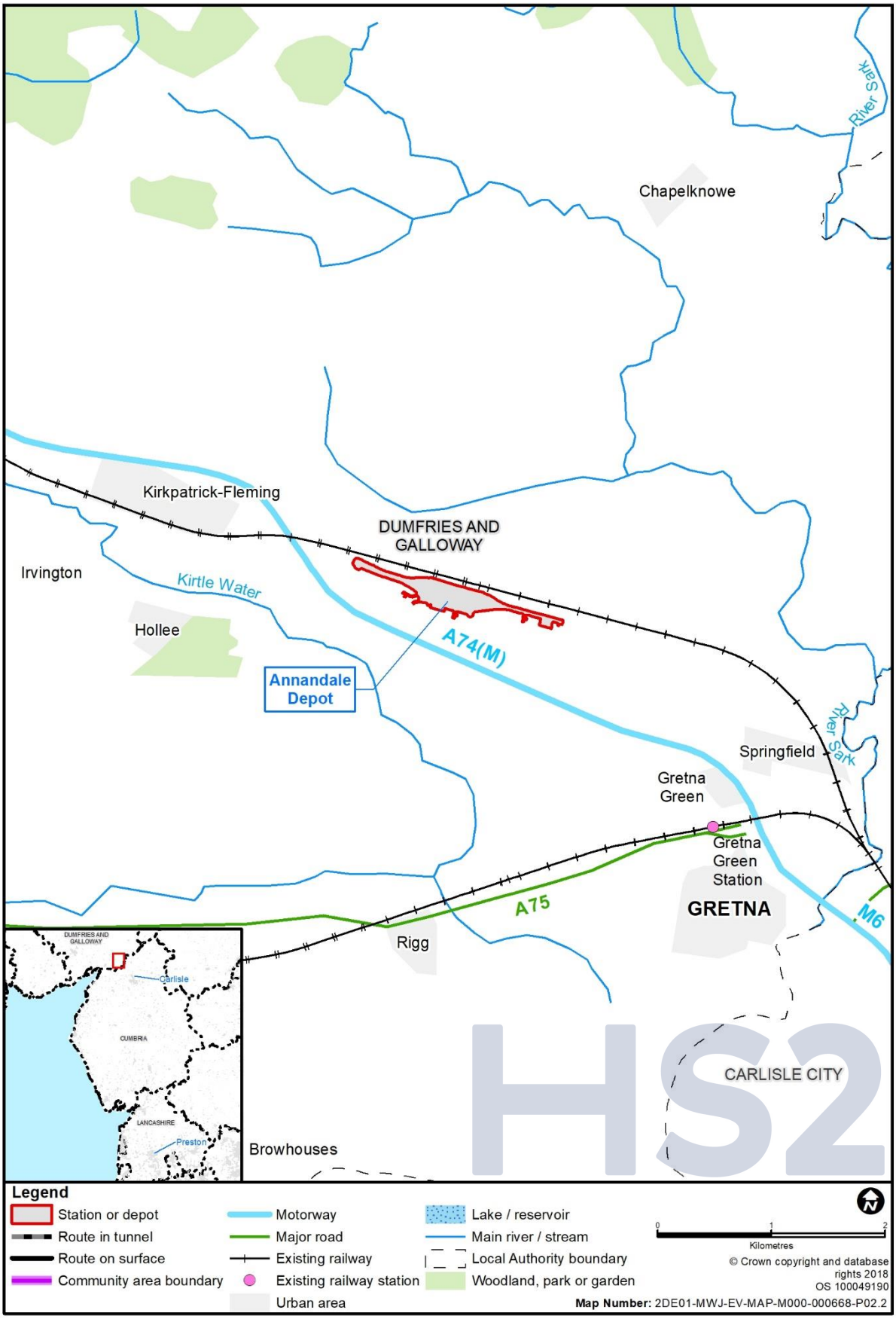
Settlement, land use and topography

6.1.3 The Annandale area is predominantly rural in character with agriculture being the main land use. This is interspersed with areas of woodland, isolated dwellings and farmsteads.

6.1.4 A number of listed buildings are located in the area, including Grahamshill Farmhouse and Steading, which lies south of the land required for the construction of the Proposed Scheme.

6.1.5 The land within the Annandale area is undulating. The highest point at 100m above Ordnance Datum (AOD) is located to the north of Kirkpatrick-Fleming and the A74(M) in the north-east of the Annandale area. The lowest point at 20m AOD is located to the south of the B7076 and the A74(M) in the south of the Annandale area.

Figure 12: Annandale area context map



Key transport infrastructure

6.1.6 The Annandale area is within a key Scotland-England transport corridor accommodating the WCML, the A74(M) and the B7076.

6.1.7 The A74(M), which connects the A75 and the M6, passes through the Annandale area in a south-east to north-west direction on the southern side of the Proposed Scheme. The local roads in the area include the B7076; the B6357, which links Kirkpatrick-Fleming to Chapelknowe; and the Gretna Green motorway services access road.

6.1.8 The WCML passes through the area, running in a south-east to north-west direction on the northern side of the Proposed Scheme.

6.1.9 Other key transport infrastructure in this area includes Gretna Green Station, which lies in the south-east of the Annandale area. This provides access to local services to Glasgow, Carlisle, Dumfries and Newcastle. There is also one bus route, service 382, that operates on the B7076 between Carlisle, Gretna and Lockerbie. Two national cycle routes 7 and 74, which are part of the National Cycle Network, connecting Glasgow with Gretna and Carlisle, are present to the south of the Annandale area.

Socio-economic profile

6.1.10 The agriculture, forestry and fishing sector accounts for the largest proportion of businesses (27%) within the DGC area, followed by the retail (9%) and construction (9%) sectors[115].

6.1.11 According to the Annual Population Survey (2020)[116], the employment rate (the proportion of residents aged 16 – 64 in employment) within the DGC area was 69% (57,800 people). The unemployment rate within the DGC area was 6%.

6.1.12 The same survey indicates that 37% of residents aged 16 – 64 in the DGC area were qualified to National Vocational Qualification Level 4 (NVQ4) and above, while 9% of residents had no qualifications.

Notable community facilities

6.1.13 The Annandale area is rural with limited services and community facilities.

6.1.14 The medical facilities within the Annandale area comprise Gretna Surgery.

6.1.15 Educational facilities within the Annandale area include Springfield Primary School, Kirkpatrick-Fleming Primary School and Gretna Primary School.

[115] Office for National Statistics (2020), *UK Business Counts - Local units by industry and employment size band 2020.* Available online at: http://www.nomisweb.co.uk/datasets/idbrlu.

[116] Office for National Statistics (2020), *Annual Population Survey,* NOMIS. Available online at: http://www.nomisweb.co.uk/datasets/apsnew. This number includes the jobs held by residents of DGC irrespective of where they work.

6.1.16 Places of worship within the Annandale area include Gretna Old Parish Church.

Recreation, leisure and open space

6.1.17 The Annandale area is predominantly rural. Recreational facilities include Gretna Library; Westlands Country Park, which provides shooting and fishing facilities and holiday lodges; and Bruce's Cave Caravan and Camping Park.

6.1.18 Core paths established by DGC in the area include the Bensmoor Wood to Douglas Steading core path and the Gretna Service Area to Gretna core path.

Policy and planning context

6.1.19 Volume 1, Introduction and methodology, provides an overview of the policy case for HS2.

Planning framework

6.1.20 Relevant development plan documents and other planning policies have been considered in relation to environmental topics, as part of considering the Proposed Scheme in the local context. Development plan documents and other planning policies relevant to the Annandale area are listed in Volume 5: Appendix CT-004-OR003, Planning data.

6.1.21 These have been considered and referred to where appropriate in the assessments reported in Section 6.3 of this report.

Committed development

6.1.22 Committed developments are defined as developments with planning permission and sites allocated for development, or safeguarded for minerals in adopted development plans, on or close to the land required for the Proposed Scheme. Section 7 of Volume 1, Introduction and methodology, sets out the approach to identifying and considering committed developments in the assessment. The committed developments relevant to the assessment of the Proposed Scheme in the Annandale area are listed in Volume 5: Appendix CT-004-OR003, Planning data and are shown in Volume 5, Planning Data/Committed Development Map Book, Map CT-13-805 to CT-13-806.

6.1.23 These have been considered to determine whether they would result in a material change to the future baseline or have the potential to give rise to cumulative effects for each environmental topic. The committed developments considered in the assessment for the Annandale area are reported in the relevant topic sections of this report.

Description of the Proposed Scheme

6.1.24 The following section describes the main features of the Proposed Scheme in the Annandale area including the proposed environmental mitigation measures that have been identified. Further general information on typical permanent features is provided in Volume 1,

Introduction and methodology, Section 5. Similarly, a general description of the approach to mitigation is explained in Volume 1, Introduction and methodology, Section 9. Some of the mitigation described in this section has been provided on a precautionary basis. This is described below in the ecology and biodiversity, historic environment, land quality, landscape and visual, sound, noise and vibration and water resources and flood risk assessments reported in Section 6.3.

6.1.25 The Proposed Scheme will occupy 80ha of land and will be located to the north-west of Gretna Green on an area of existing agricultural land. Land required for operation of the Proposed Scheme is shown on Volume 4: Map Series CT-06. Land required for construction is shown on Volume 4, Off-route effects Map Book, Map Series CT-05.

6.1.26 All dimensions in the sections below are approximate.

6.1.27 The Proposed Scheme will include the following (see Volume 4, Off-route effects Map Book, Map CT-06-804 to CT-06-807):

- a site entrance at the end of a new access road off the B7076. This will extend into an internal road network leading to the main buildings and staff car park;
- a stabling area where trains will be cleaned and stabled overnight. The stabling area will comprise 14 sidings up to 400m long, each able to hold two 200m train sets;
- lighting columns, up to 4m in height to illuminate the stabling area, along with low level lights for pedestrian paths between work areas;
- a controlled access level crossing across the reception tracks for emergency vehicles crossing the depot sidings at both ends;
- Cranberry Farm accommodation overbridge, 20m in length, up to 5m above ground level and 6m above track level, to carry the realigned access road to Cranberry Farm over the southern reception tracks;
- a four-track maintenance shed for the servicing, cleaning and maintenance of passenger rolling stock, 250m by 70m by 16m high;
- separate structures for carriage washing plant and automatic vehicle inspection along the southern reception tracks;
- an accommodation building comprising a workshop, offices and stores adjacent to the southern side of the four-track maintenance shed, 250m by 16m by 13m high;
- a wastewater treatment plant;
- a traction sub-station;
- an underpass beneath the depot sidings for pedestrian access, including stairs and ramps to platforms and tracks. Entrance to the underpass will be via a ramp, located to the south-east of the depot sidings;
- a staff car park, with 120 car spaces; and
- a headshunt 300m in length (this is a section of track provided to allow locomotives or rolling stock to be moved between the sidings) in cutting up to 10m below ground level.

6.1.28 The Proposed Scheme will connect to the WCML via three reception tracks, comprising two southern reception tracks located to the west of Blacksike Bridge (see Volume 4, Off-route effects Map Book, Map CT-06-805, G5) and one northern reception track located to the south of Grahamshill Railway Cottages (see Volume 4, Off-route effects Map Book, Map CT-06-806, D5). Trains will access the depot sidings from the WCML via these reception tracks.

6.1.29 In addition, there will be minor modifications to the track layout, signalling, overhead line equipment and other railway systems on the WCML within the Annandale area to facilitate the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-804, A3 to G7; Map CT-06-805, A5 to J5; Map CT-06-806, A5 to J5 and Map CT-06-807, B6 to J5).

6.1.30 The Proposed Scheme will also include the following:

- a balancing pond for highways drainage, 100m north-west of Cranberry Farm accommodation overbridge. Access will be provided from a new access track via the unnamed road, north of Cranberry Farm accommodation overbridge (see Volume 4, Off-route effects Map Book, Map CT-06-805, D5);
- a balancing pond for highways drainage, 100m south-west of Cranberry Farm accommodation overbridge. Access will be provided from a new access track via the unnamed road, south of Cranberry Farm accommodation overbridge (see Volume 4, Off-route effects Map Book, Map CT-06-805, D6 to D7);
- a balancing pond for railway drainage, 500m west of Cranberry Farm accommodation overbridge. Access will be provided from a new access track via the unnamed road, north of Cranberry Farm accommodation overbridge (see Volume 4, Off-route effects Map Book, Map CT-06-805, B5);
- a balancing pond for highways drainage, 40m south of the accommodation building. Access will be via the access road (see Volume 4, Off-route effects Map Book, Map CT-06-806, H7);
- a balancing pond for highways drainage, 250m south-west of the accommodation building. Access will be via the access road (see Volume 4, Off-route effects Map Book, Map CT-06-806, F7 to F8); and
- a balancing pond for railway drainage, 150m west of the accommodation building. Access will be via the access road (see Volume 4, Off-route effects Map Book, Map CT-06-806, F6 to F7).

6.1.31 Pumping station sites to manage drainage and general wastewater from the Proposed Scheme will be located:

- 700m east of the Cranberry Farm accommodation overbridge. Access will be provided from an existing unnamed road, south of Blacksike Bridge (see Volume 4, Off-route effects Map Book, Map CT-06-805, H6); and
- 200m west of the Annandale depot traction sub-station. Access will be via the access road (see Volume 4, Off-route effects Map Book, Map CT-06-805, B6).

6.1.32 To accommodate the Proposed Scheme, the following works to public highways and access roads will be required:

- widening of the B7076 carriageway with a new dedicated traffic lane in the centre of the carriageway provided for access to the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-806, E8 to G8);
- realignment of an existing unnamed road providing access to Cranberry Farm and Valley Cottage. The unnamed road will be realigned up to 50m south of its current alignment, crossing the southern reception tracks on the Cranberry Farm accommodation overbridge and maintaining access to Cranberry Farm and Valley Cottage via an existing WCML overbridge (see Volume 4, Off-route effects Map Book, Map CT-06-805, E6);
- closure of an unnamed road providing access to Williamsfield Farm and Williamsfield Cottage at the junction of the B7076. Users will be diverted for 3.2km along the B7076 and the realigned unnamed road and Cranberry Farm accommodation overbridge passing Cranberry Farm and along the Williamsfield Farm access diversion (see Volume 4, Off-route effects Map Book, Map CT-06-806, H3 to H9); and
- diversion of an access road to Williamsfield Farm and Williamsfield Cottage located to the north of the Proposed Scheme; access will be provided from an unnamed road to the east, north of Cranberry Farm (see Volume 4, Off-route effects Map Book, Map CT-06-805, E3, to CT-06-806, H4).

6.1.33 Two watercourse realignments are proposed on Ewes Burn around the southern edge of the southern reception tracks and depot sidings. One realignment up to 800m long, including 45m of culvert beneath the Cranberry Farm accommodation overbridge, and one realignment of up to 180m long (see Volume 4, Off-route effects Map Book, Map CT-06-805, D6 to A6 and CT-06-806, I7 to J7).

6.1.34 To accommodate the realignment of Ewes Burn, an unnamed watercourse (Tributary of the Ewes Burn 2) will be diverted for 150m beneath the northern reception track and depot sidings (see Volume 4, Off-route effects Map Book, Map CT-06-805, A6). To accommodate this diversion the following culverts will be provided:

- northern reception track culvert, 650m west of the Cranberry Farm accommodation overbridge, to convey an unnamed watercourse (Tributary of the Ewes Burn 2) (see Volume 4, Off-route effects Map Book, Map CT-06-805, A6); and
- depot sidings culvert, 650m west of the Cranberry Farm accommodation overbridge, to convey an unnamed watercourse (Tributary of the Ewes Burn 2) (see Volume 4, Off-route effects Map Book, Map CT-06-805, A6).

6.1.35 In addition, a further unnamed watercourse (Tributary of the Ewes Burn 1) will be diverted for 400m around the southern edge of the depot sidings (see Volume 4, Off-route effects Map Book, Map CT-06-806, H8 to F7). To accommodate this diversion an access road culvert, 100m south-west of the depot sidings, will be provided.

6.1.36 A Scottish Power 132kV overhead power line will be permanently diverted, for 750m in length, to accommodate the Proposed Scheme. The overhead power line will be re-routed

underground west of Cranberry Farm, underneath the WCML and the southern reception tracks, before reconnecting above ground south of the land required for the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-805, D3 to B7).

6.1.37 To accommodate the Proposed Scheme, the following works to minor utilities will be required:

- permanent diversion of a Scottish Power 11kV overhead power line to accommodate the connection of the southern reception tracks to the WCML (located within the area shown on Volume 4, Off-route effects Map Book, Map CT-06-805);
- permanent diversion of a Scottish Water potable water main to accommodate the Cranberry Farm accommodation overbridge (located within the area shown on Volume 4, Off-route effects Map Book, Map CT-06-805);
- permanent diversion of two Scottish Power 11kV overhead power lines, a Scottish Water potable water main and an Openreach telecommunications cable to accommodate the Proposed Scheme (located within the area shown on Volume 4, Off-route effects Map Book, Map CT-06-805 and Map CT-06-806); and
- permanent diversion of a Scottish Power low-voltage overhead power line and two Scottish Water potable water mains to accommodate the headshunt (located within the area shown on Volume 4, Off-route effect Map Book, Map CT-06-806).

6.1.38 The following mitigation measures will be included:

- landscape earthworks, up to 2m in height, beginning at the connection of the southern reception tracks to the WCML and continuing along the southern side of the southern reception tracks to the Cranberry Farm accommodation overbridge. The landscape earthworks will provide visual screening for residents of properties to the south of the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-805, H5 to E6);
- landscape mitigation planting on both sides of the southern reception tracks to provide visual screening for residents of properties to the north and south of the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-805, G5 to D5 and E6 to A6);
- areas of grassland habitat creation on the northern side of both the southern and northern reception tracks, to provide replacement habitat (see Volume 4, Off-route effects Map Book, Map CT-06-805, F5 to A5);
- landscape mitigation planting on the northern side of the northern reception track to provide visual screening for residents of properties to the north of the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-805, D5 to A5 and Map CT-06-806 J5 to I5);
- landscape earthworks, up to 5m in height, beginning at the Cranberry Farm accommodation overbridge and continuing along the southern side of the Proposed Scheme to the unnamed watercourse diversion. The landscape earthworks will provide visual screening for residents of properties to the south of the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-805, D6 to A6);

- an area of grassland habitat creation on the southern side of the southern reception tracks, to provide replacement habitat (see Volume 4, Off-route effects Map Book, Map CT-06-805, C6 to A6);
- an area of wetland habitat creation to the south of the Proposed Scheme extending to the south of the Ewes Burn, to provide replacement habitat (see Volume 4, Off-route effects Map Book, Map CT-06-805, D7 to A7 and Map CT-06-806, J7 to I7);
- landscape mitigation planting on the southern side of the Proposed Scheme to provide visual screening for residents of properties to the south of the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map CT-06-806, J6 to F7);
- landscape earthworks, up to 3m in height, beginning at the unnamed watercourse diversion and continuing along the southern side of the Proposed Scheme to the access road. The landscape earthworks will provide visual screening for residents of properties along the B7076 (see Volume 4, Off-route effects Map Book, Map CT-06-806, J6 to F7);
- two areas of woodland habitat creation on the southern side of the Proposed Scheme to provide replacement habitat (see Volume 4, Off-route effects Map Book, Map CT-06-806, I7 to H8 and F7);
- an area of grassland habitat creation on the southern side of the accommodation building to provide replacement habitat (see Volume 4, Off-route effects Map Book, Map CT-06-806, I7 to H7);
- landscape mitigation planting located between the northern reception track and the depot sidings to provide visual screening for residents of properties to the north of the WCML (see Volume 4, Off-route effects Map Book, Map CT-06-806, I5 to E5);
- an area of woodland habitat creation located between the northern reception track and the depot sidings to provide replacement habitat (see Volume 4, Off-route effects Map Book, Map CT-06-806, F5 to D5);
- landscape earthworks, up to 2m in height, beginning at the access road and continuing along the southern side of the depot sidings and around the headshunt. The landscape earthworks will provide visual screening for residents of properties to along the B7076 (see Volume 4, Off-route effects Map Book, Map CT-06-806, F7 to C5); and
- an area of grassland habitat creation located around the headshunt on the west of the Proposed Scheme, to provide replacement habitat (see Volume 4, Off-route effects Map Book, Map CT-06-805, E6 to B6).

Demolitions

6.1.39 No demolitions will be required to construct the permanent features or to enable the construction works for the Proposed Scheme in the Annandale area.

Construction of the Proposed Scheme

Introduction

6.1.40 Volume 1, Introduction and methodology, Section 6 provides details of the typical construction techniques which will be used to construct the Proposed Scheme. Section 2 of this report describes the typical approach to the key construction activities needed to build the Proposed Scheme. This section provides information on the construction activities that are envisaged to be needed to build the Proposed Scheme in the Annandale area, which provide the basis for the construction assessment.

General overview of the construction compounds

6.1.41 This section provides a summary of the works to be managed from the construction compounds in the Annandale area, as illustrated in Figure 13 and Figure 14. All dates and durations of activities and numbers of workers are indicative. All compounds will undertake initial site set-up works, and at the end of use, finalisation works including site reinstatement, landscaping and planting (as necessary).

Figure 13: Construction compounds for civil engineering works

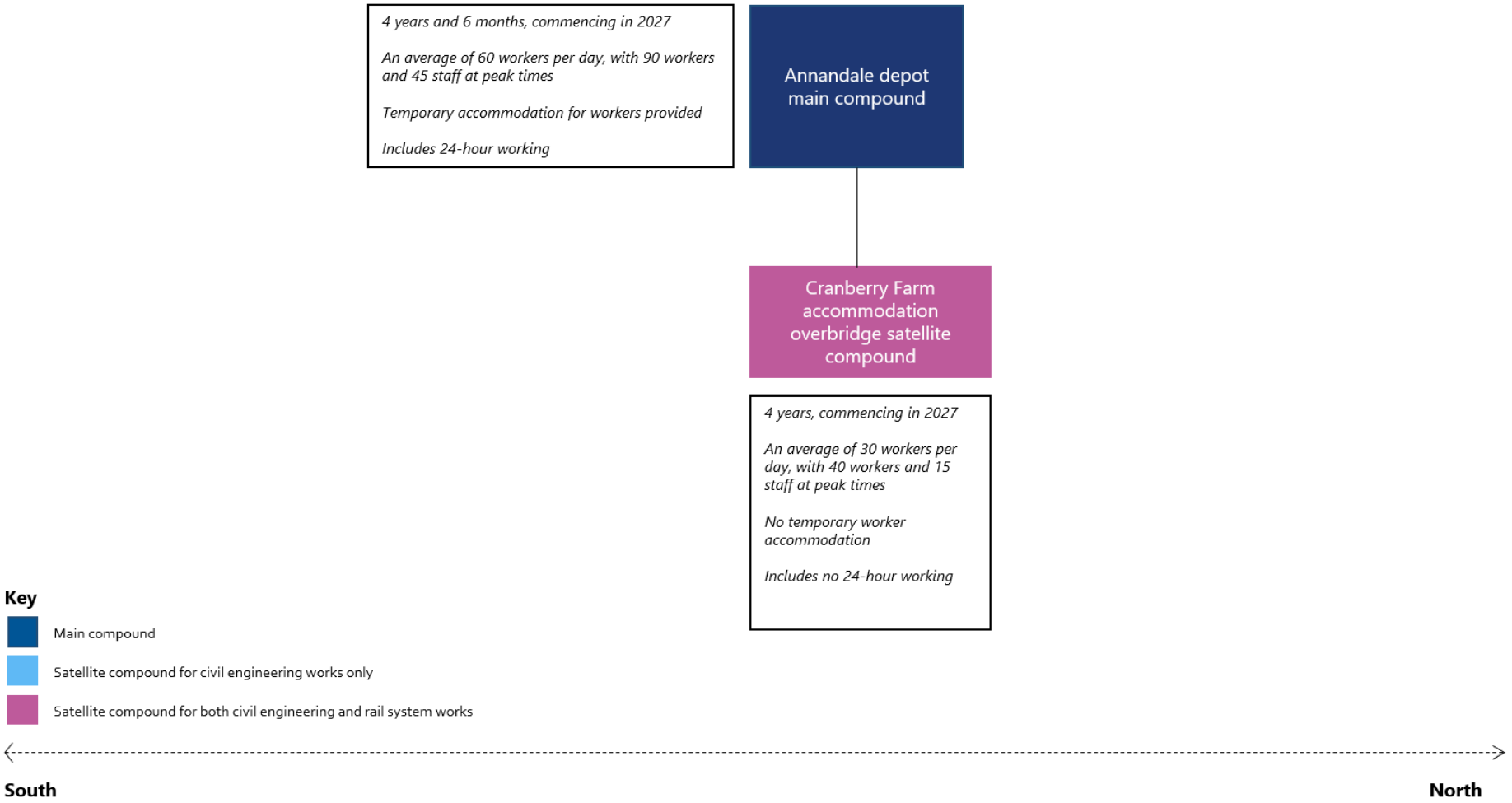
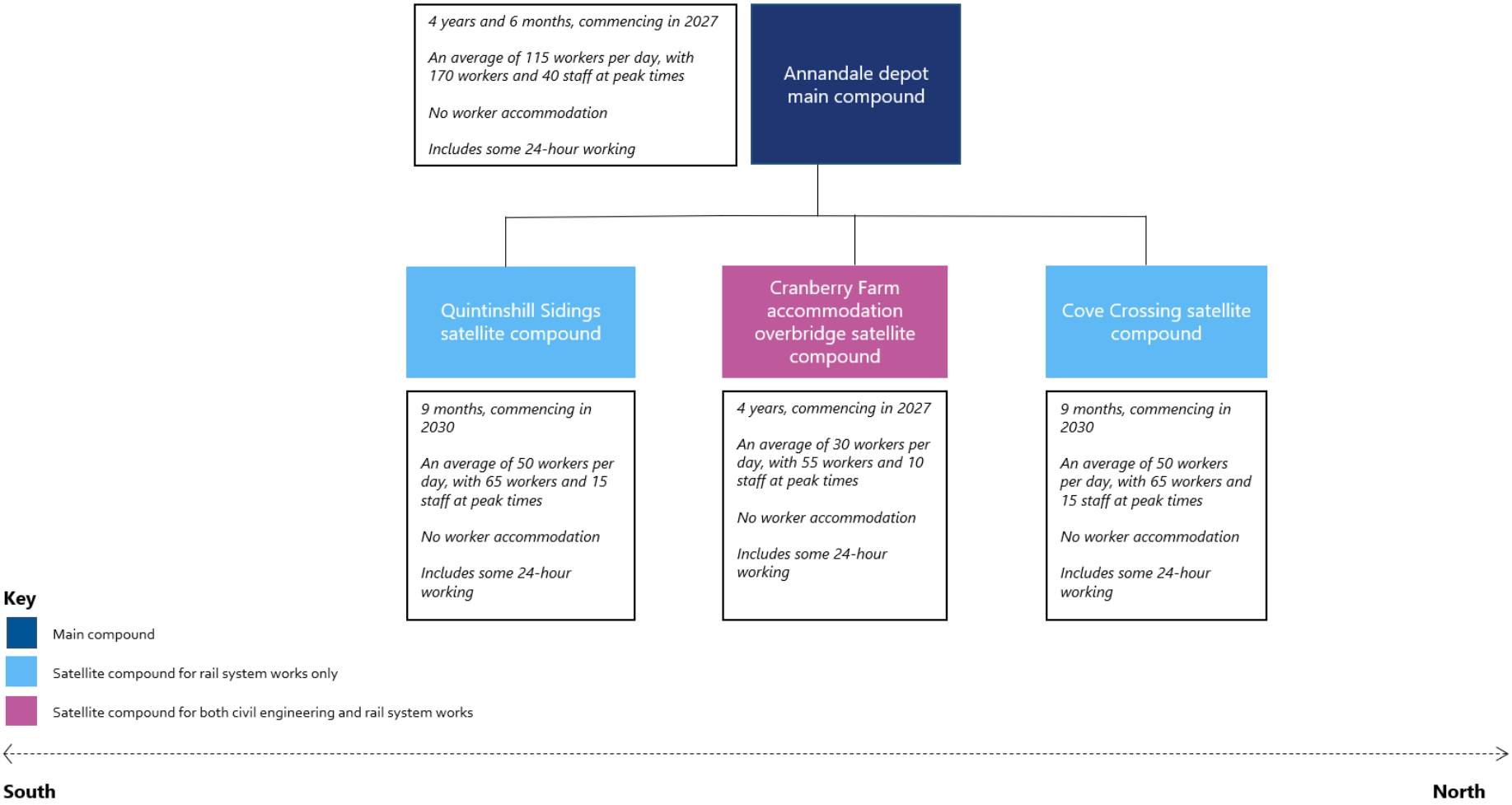


Figure 14: Construction compounds for railway systems engineering works



Annandale depot main compound

6.1.42 This compound (see Volume 4, Off-route effects Map Book, Map CT-05-806, H7 to I8) will be used to manage both civil engineering and railway systems works. It will:

- be used to manage civil engineering works for a period of three years and six months, followed by railway systems works for a period of nine months, and then civil engineering works for a period of three months;
- provide main compound support to one civil engineering satellite compound and three railway systems compounds in the Annandale area, as illustrated on Figure 13 and Figure 14; and
- be accessed via an unnamed road off the B7076 (see Volume 4, Off-route effects Map Book, Map CT-05-806, H7).

6.1.43 No demolitions will be required as a result of the works to be managed from this compound.

6.1.44 The compound will be used to manage the construction of the Annandale depot, which will take three years to complete.

6.1.45 Key railway systems installation works to be managed from this compound include the installation of railway systems for the Annandale depot, which will take one year and three months to complete.

6.1.46 In addition, the following utility works will be carried out during the construction period:

- permanent diversion of three Scottish Power 11kV overhead power lines;
- permanent diversion of four Scottish Water potable water mains;
- permanent diversion of a Scottish Power 132kV overhead power line;
- permanent diversion of an Openreach telecommunications cable; and
- permanent diversion of a Scottish Power low voltage overhead power line.

Quintinshill Sidings satellite compound

6.1.47 This compound (see Volume 4, Off-route effects Map Book, Map CT-05-804, B3) will be used to manage railway systems. It will be accessed via an unnamed road off the B7076.

6.1.48 No demolitions will be required as a result of the works to be managed from this compound.

6.1.49 The compound will be used to manage the connection of the Proposed Scheme to the existing WCML, which will take nine months to complete.

Cranberry Farm accommodation overbridge satellite compound

6.1.50 This compound (see Volume 4, Off-route effects Map Book, Map CT-05-805, D6) will be used to manage civil engineering and railway systems works. It will be accessed via an unnamed road off the B7076.

6.1.51 No demolitions will be required as a result of the works to be managed from this compound.

6.1.52 The compound will be used to manage the construction of the Cranberry Farm accommodation overbridge, which will take one year and six months to complete.

6.1.53 Key railway systems installation works to be managed from this compound include the installation of railway systems for the Proposed Scheme, which will take one year to complete.

Cove Crossing satellite compound

6.1.54 This compound (see Volume 4, Off-route effects Map Book, Map CT-05-807, B6) will be used to manage railway systems works. It will be accessed via an unnamed road off the B7076.

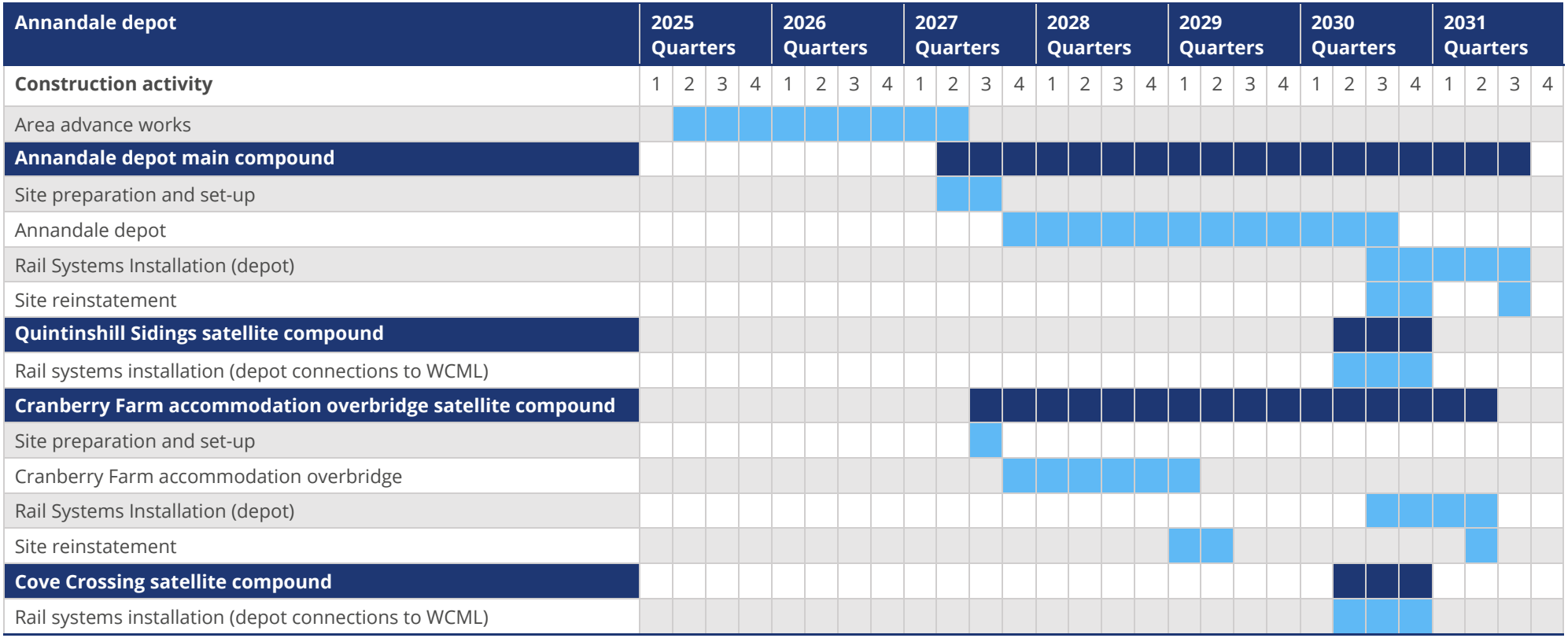
6.1.55 No demolitions will be required as a result of the works to be managed from this compound.

6.1.56 The compound will be used to manage the connection of the Proposed Scheme to the existing WCML, which will take nine months to complete.

Construction programme

6.1.57 A construction programme illustrating indicative periods for each of the core construction activities described above is provided in Figure 15.

Figure 15: Indicative construction programme for the Proposed Scheme between 2025 and 2031



Operation of the Proposed Scheme

Introduction

6.1.58 This section describes the operational characteristics of the Proposed Scheme in the Annandale area. Volume 1, Introduction and methodology, Section 4 describes the envisaged operational characteristics of the Proposed Scheme as a whole, including Phase One, Phase 2a and Phase 2b.

HS2 services

6.1.59 It is anticipated that there will be up to five HS2 trains per hour each way passing through the Annandale area on the WCML. Services are expected to operate between 05:00 and midnight from Monday to Saturday and between 08:00 and midnight on Sunday.

6.1.60 Trains will run at speeds of up to 200kph (125mph), as per the current line speeds in the area. The trains will be either single 200m trains or two 200m trains coupled together, depending on demand and time of day.

6.1.61 The Proposed Scheme will provide overnight stabling for up to 28 HS2 trains including those HS2 trains both in service and not in service. This will include 13 operational HS2 trains (seven 400m units and six 200m units) anticipated to arrive at Annandale depot between 22:00 and 01:30. A total of 14 operational HS2 trains (six 400m units and eight 200m units) are anticipated to depart Annandale depot in the morning between 05:00 and 09:00.

6.1.62 The Proposed Scheme will also provide stabling for HS2 trains which are not currently in operation due to maintenance or are kept on standby to enter service if required.

6.1.63 Trains will run at speeds of up to 65kph (40mph) when arriving at and departing from Annandale depot. Within Annandale depot, trains will run at speeds of up to 25kph (15mph).

Maintenance

6.1.64 Volume 1, Introduction and methodology, Section 4 describes the maintenance regime for the Proposed Scheme as a whole.

6.1.65 The following servicing and maintenance activities will be carried out at Annandale depot:

- train stabling overnight;
- internal overnight cleaning;
- periodic heavy cleaning;
- emptying and replenishing of train toilets;
- external washing;
- light maintenance (inspections, minor component changes etc.);
- training and meetings facilities; and
- storage of spare equipment.

6.1.66 Annandale depot will be operational 24 hours per day, seven days a week with associated directional permanent lighting. An accommodation building will be provided for maintenance staff, cleaning staff and train crew. In addition to these site operatives, there will also be office-based staff supporting site and network operations. In total, Annandale depot will provide 170 HS2-related jobs. Welfare areas and parking will be required at all hours, as there are anticipated to be three shifts per 24 hours.

6.2 Stakeholder engagement

Introduction

6.2.1 This section summarises the approach to stakeholder engagement and consultation for the Proposed Scheme in the Annandale area.

Consultation on the working draft ES

6.2.2 As set out in Volume 1, Introduction and methodology, Section 3, two parallel consultations were undertaken by HS2 Ltd in 2018: a consultation on the working draft ES and a consultation on the working draft EQIA. These consultations related to the full Phase 2b Scheme (including both Eastern Leg and Western Leg). As part of the process of consultation, stakeholders were invited to comment on the full Phase 2b Scheme and the working draft ES and working draft EQIA Report. Documents were made available on the gov.uk website.

6.2.3 At the time of publication of the working draft ES, the location of the proposed Annandale depot was not confirmed and therefore no community information events were held relating to Annandale depot. Consultation responses were however encouraged on the proposition of a depot between Carlisle, Glasgow and Edinburgh near to the WCML.

Consultation on design refinements

6.2.4 Design refinements to the Proposed Scheme relating to the Annandale depot were consulted upon between October and December 2020.

6.2.5 Documents containing information about the proposed design refinements, along with supporting information such as visualisations and construction and operational plans, were made available on the gov.uk webpage. Information was also made available on the hs2.org.uk webpage, where an interactive map and a virtual exhibition room provided alternative ways for people to access the information. Printed copies of the consultation materials were sent free of charge following requests to the HS2 Helpdesk.

6.2.6 Stakeholders were invited to comment on the proposed design refinements either by using an online response form or submitting comments by post.

6.2.7 A total of 326 responses were received through the consultation on design refinements. These responses were analysed and the themes and issues relevant to Annandale depot included:

- noise and air quality impacts during both construction and operation and also concerns regarding light pollution;
- visual and landscape impacts and the setting of the depot within a largely rural and agricultural environment;
- concern regarding the potential impact of construction traffic on the local highways network, particularly the B7076, and how this would affect traffic movements;
- potential impact on local property values during both construction and operation;
- interface of the depot with the WCML and impacts on local rail services; and
- job opportunities that could be created by the depot.

6.2.8 A summary of the comments received during this consultation is available at the gov.uk website.

Engagement and consultation with stakeholder groups

6.2.9 The purpose of engagement with community stakeholders has been to provide affected communities with information on the development of the Proposed Scheme and to give the opportunity to raise issues in relation to the design and assessment of the Proposed Scheme. Feedback from communities has helped inform the baseline information and evolving assessment of impacts in this ES and concurrent EQIA, as well as identify opportunities for mitigation within the design.

6.2.10 In October and November 2020, information events were held using online channels including webinars and a virtual exhibition room. Further information events were held in June and July 2021 which included an in-person event at Gretna Green, supported by online webinars. Members of local communities and other interested parties were invited to engage on issues pertinent to the development of the Proposed Scheme design and its assessment

6.2.11 Engagement has been, and will continue to be, offered with community stakeholders, particularly those close to the Proposed Scheme. These stakeholders include educational establishments, organisations with specialist interests or those catering to the needs of vulnerable people within the community.

6.2.12 Direct engagement has been offered to and undertaken with the local authority and community councils as well as community stakeholders, technical and specialist organisations and statutory bodies relating to the Annandale area. The purpose of this engagement was to collate local baseline information and knowledge to inform the design and assessment, identify and understand local issues and concerns, provide access to wider stakeholders and communities and provide a mechanism for ongoing dialogue and discussion on the assessment and design development.

6.2.13 Engagement has also focused on the technical areas that inform the assessment, including agriculture, forestry and soils, ecology and biodiversity, historic environment, landscape and visual, sound, noise and vibration and water resources and flood risk, amongst others.

6.2.14 Briefings were offered to specialist and technical stakeholders across the Proposed Scheme during the period of consultation on the Design Refinements between October and December 2020 (using online channels) to provide information on the evolving design and assessment of the Proposed Scheme in their respective areas.

6.2.15 Targeted engagement was also offered to those stakeholders who have land, property or business operations directly affected by the construction and/or operation of the Proposed Scheme to meet with technical experts at these events, to gain better understanding of emerging design and share their thoughts on how this might affect them. Whilst these opportunities did not replace their right to respond formally to consultation, their feedback has also been considered during design development.

6.2.16 Engagement has been undertaken with major asset owners and businesses within the Annandale area including Cranberry Farm, Redhouse Farm and the Mill Forge hotel and wedding venue. The purpose of this engagement has been to obtain baseline information and provide these stakeholders with the opportunity to raise issues and discuss mitigation in relation to the Proposed Scheme. Key issues raised during this engagement have included:

- viability of farming operations and commercial development opportunities;
- access to property and land;
- noise and visual impacts during construction and operation;
- impact on the environment and quality of life; and
- reduction in value (blight) of remaining land.

6.2.17 HS2 Ltd has offered to engage with all relevant MPs and MSPs[117] during the development of the Proposed Scheme in order to discuss key issues and concerns.

6.2.18 Table 15 summarises key engagement undertaken with all stakeholders relating to the Annandale depot to date, including local authorities, statutory bodies, specialist organisations and community stakeholders. This includes a summary of the focus of the engagement and how this has informed the design and assessment of the Proposed Scheme.

Table 15: Engagement to date with stakeholders

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Local authority	Dumfries and Galloway Council	Series of meetings to discuss the Proposed Scheme, provide updates on consultation activities and understand potential impacts on the local community. Key discussion points included proximity to national and international	Feedback used to improve understanding of baseline conditions, potential impacts and proposed mitigation concerns and opportunities.

[117] Members of Parliament (MPs), Members of Scottish Parliament (MSPs).

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
		ecological designations as well as impacts on the local community and businesses during construction and operation.	
Statutory and national	Scottish Environment Protection Agency	Agriculture, land quality, water and flood risk issues.	Informed agricultural, land quality, ecological, water and flood risk, Water Framework Directive methodology, baseline conditions. Informed the assessment and proposed mitigation for sensitive receptors including Raeburn Flow (Special Area of Conservation (SAC)), site of special scientific interest (SSSI), the Upper Solway Flats and Marshes (Special Protection Area (SPA)), Ramsar, SSSI) and Solway Firth (SAC).
Statutory and national	NatureScot (formerly Scottish Natural Heritage)	Ecology, agricultural, land quality and landscape and visual related issues.	Provided information regarding the natural environment and informed methodological approach and detailed local conditions and factors to be taken into consideration in the assessment, including Raeburn Flow (SAC, SSSI), the Upper Solway Flats and Marshes (SPA, Ramsar, SSSI) and Solway Firth (SAC).
Statutory and national	Historic Environment Scotland	Nationally designated heritage assets and the heritage assessment methodology.	Informed methodology for assessing setting and impacts on historic landscape at national and regional level. Identification and assessment methodology of designated and non-designated heritage assets.
Statutory and national	Network Rail	Rail infrastructure.	Informed considerations around rail infrastructure network and factors to be considered in the design and assessment of the Proposed Scheme, including the interface with Annandale depot.
Statutory and national	Scottish Forestry	Forestry, ecology and landscape issues.	Informed the ecological and landscape assessment methodology, improved understanding of baseline conditions and the assessment and proposed mitigation.
Statutory and national	Transport Scotland	Strategic road network, traffic and transport issues.	Informed the assessment of road network capacity and

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
			identification of proposed future works by Transport Scotland including the A74(M) and the B7076 near Annandale depot.
Local authority technical meetings	Dumfries and Galloway Council	Engagement to discuss the sound, noise and vibration assessment including proposed mitigation.	Information used to improve understanding of local conditions and factors used to inform the baseline conditions and the emerging design of the Proposed Scheme and assessment.
Local authority technical meetings	Dumfries and Galloway Council	Meeting to discuss the ecology and biodiversity assessment and the mitigation strategy, particularly in regard to: • Raeburn Flow (SAC, SSSI); • the Upper Solway Flats and Marshes (SPA, Ramsar, SSSI); and • Solway Firth (SAC) and local ancient woodlands.	Identified sensitive ecological sites and appropriate mitigation and compensation for any habitat loss associated with the Proposed Scheme.
Local authority technical meetings	Dumfries and Galloway Council	Meetings with technical leads to collate data and discuss the historic environment assessment.	Information used to improve understanding of local conditions and factors used to inform the baseline conditions and the emerging design of the Proposed Scheme and assessment.
Local authority technical meetings	Dumfries and Galloway Council	Meetings to provide information on the Proposed Scheme, obtain relevant baseline information and discuss transport survey requirements and assessment methodology relating to traffic and transport.	Information used to improve understanding of local traffic and highways operations and traffic flows to inform baseline conditions and the emerging design of the Proposed Scheme and assessment.
Local authority technical meetings	Dumfries and Galloway Council	To collate data and discuss water resources and flood risk assessment, including the impacts on the Ewes Burn watercourse.	Information used to improve understanding of local infrastructure and baseline conditions and inform the assessment and proposed mitigation.
Local authority technical meetings	Dumfries and Galloway Council	Meeting to discuss the sound, noise and vibration and air quality assessment including proposed mitigation.	Information used to improve understanding of local conditions and factors to inform scheme design and assessment relating to sound, noise and vibration.
Local authority technical meetings	Dumfries and Galloway Council	Engagement to collate data relating to land quality.	Information has been used to improve understanding of land quality baseline conditions.

Type	Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Local technical specialist group	South West Scotland Environmental Information Centre	Engagement to collate data relating to ecological assessment.	Information has been used to improve understanding of land quality baseline conditions.

6.3 Environmental assessment

Introduction

6.3.1 This section reports the environmental assessment undertaken for the Proposed Scheme in the Annandale area.

Scope, assumptions and limitations

6.3.2 The following environmental topics have been identified as relevant to the assessment of the Proposed Scheme in the Annandale area: agriculture, forestry and soils; air quality; ecology and biodiversity; historic environment; land quality; landscape and visual; socio-economics; sound, noise and vibration; traffic and transport; and water resources and flood risk. An assessment of the potential likely significant effects for these topics is reported below. All other topics were scoped out on the basis that the Proposed Scheme in the Annandale area will not give rise to the potential for likely significant effects.

6.3.3 The ES reports the significant effects of the EIA undertaken on the basis of the requirements in the Town and Country Planning (EIA) Regulations 2017 (England) and the Town and Country Planning (EIA) (Scotland) Regulations 2017. There is no substantive difference between the English and Scottish regulations. As the Annandale depot is proposed within Scotland, relevant legislation, policy and guidance has been applied and any relevant data provided by the Scottish Government, relevant local authorities and statutory bodies has been applied to the assessment of the Proposed Scheme. This section of Volume 4 of the ES uses relevant terminology, and also refers to the relevant regulatory bodies and environmental consultees for Scotland.

6.3.4 Limited survey information was available for the Annandale area due to a number of factors including national restrictions associated with COVID-19. A precautionary approach has been applied for some environmental topics (as detailed in the relevant sections below), whereby the assessment has been undertaken using alternative, appropriate sources of information and professional judgement. This constitutes a reasonable worst-case basis for the subsequent assessment.

6.4 Agriculture, forestry and soils

Introduction

6.4.1 This section provides a description of the current baseline for agriculture and soils and the likely impacts and significant effects of the construction and operation of the Proposed Scheme. Consideration is given to the extent and quality of the soil and land resources underpinning the primary land use activities of farming, and the physical and operational characteristics of enterprises engaged in these activities.

6.4.2 Details of published and publicly available information used in the assessment are shown on Map Series AG-01 (Agricultural Holdings), AG-02 (Soil Associations) and AG-04 (Agricultural Land Quality), which are provided in Volume 5, Agriculture, Forestry and Soils Map Book.

6.4.3 Maps showing the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 6.1.

6.4.4 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

6.4.5 The scope, assumptions and limitations for the agriculture and soils assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report (SMR)[118]. Whilst maintaining the main principles and meaning of the SMR, where there are differences in national planning policy, guidance and methodology for assessing agricultural land quality and soil in Scotland, these are identified below.

6.4.6 The study area for the agriculture and soils assessment covers all land required for the construction and operation of the Proposed Scheme. The resources and receptors that are assessed within this area are agricultural land and soils, together with farm and rural holdings. The assessments of the impacts on agricultural land quality are made with reference to the prevalence of prime agricultural land in the locality. The study area does not involve any land used for commercial forestry and hence this topic is scoped out for any further assessment.

6.4.7 The assessment of agricultural land quality follows the Land Capability for Agriculture (LCA) in Scotland as set out in the SMR.

6.4.8 The quality of agricultural land in Scotland has been assessed using the LCA system developed by the James Hutton Institute[119]. The LCA classification is used to rank land on the basis of its potential productivity and cropping flexibility. This is determined by the extent to

[118] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

[119] James Hutton Institute, *Land Capability for Agriculture in Scotland.* Available online at: https://www.hutton.ac.uk/learning/exploringscotland/land-capability-agriculture-scotland.

which the physical characteristics of the land (soil, climate and relief) impose long-term restrictions on its use. The LCA is a seven-class system. Four of the classes are subdivided into divisions. Class 1 represents land that has the highest potential flexibility of use, whereas Class 7 land is of very limited agricultural value. As described in paragraph 80 of the Scottish Planning Policy (2014)[120], prime agricultural land is a limited resource of national importance as it can be used to grow a wide range of agricultural and non-agricultural crops. The prime agricultural land falls in Classes 1, 2 and 3.1. The agricultural policy of protecting prime agricultural land from development is implemented through development plans and development control under the Town and Country Planning (Scotland) Act 1997.

6.4.9 In accordance with the SMR, the assessment of agricultural land quality is two-fold. First, an interpretation of published geological, topographical, soil and agro-climatic information is undertaken in the light of the Land Capability Classification for Agriculture guidelines[121] to provide a prediction of the likely classes of agricultural land that will be affected. Then the predicted LCA class is augmented with the results of detailed LCA surveys undertaken by the James Hutton Institute, which includes surveys covering the area of land required for the construction of the Proposed Scheme. The 1:50,000 scale maps produced by the James Hutton Institute cover LCA Classes 1, 2 and 3.1[122]. As the LCA maps identify the location and extent of prime agricultural land, no additional soil surveys are necessary as part of this assessment.

6.4.10 The primary functions provided by soils other than for food and biomass production, include flood water attenuation, carbon storage or the support of ecological habitats. This section describes these functions and assesses the ability of the soils to fulfil their primary functions after construction of the Proposed Scheme. Soil attributes, other than for food and biomass production, are identified in this assessment, but the resulting function or service provided is assessed and reported elsewhere, notably in the historic environment, ecology and biodiversity, landscape and visual, and water resources and flood risk assessments in this section. The function of soil as a carbon store is described under climate change in Volume 3, Route-wide effects, Section 4 of the Environmental Statement (ES).

6.4.11 The main issue for agricultural holdings is disruption by the Proposed Scheme of the physical structure of the holding and the operations taking place upon them, during both construction and operational phases. Where any part of a farm or rural holding is required for the construction or operation of the Proposed Scheme, the whole land holding is part of the study area for impacts on this receptor.

6.4.12 Common assumptions that have been used in assessing the effects of the Proposed Scheme are set out in Volume 1, Introduction and methodology, Section 8. These assumptions

[120] Scottish Government (2014), *Paragraph 80 of Scottish Planning Policy*. Available online at: https://www.gov.scot/publications/scottish-planning-policy/pages/5/.

[121] Bibby, J.S., Douglas, H.A., Thomasson, A.J. and Robertson, J.S. (1991), *Land Capability Classification for Agriculture.* Macaulay Land Use Research Institute, Aberdeen. ISBN 0 7084 05088.

[122] The James Hutton Institute (2021), *Land Capability for Agriculture Partial Cover*. Available online at: https://soils.environment.gov.scot/maps/capability-maps/land-capability-for-agriculture-partial-cover/.

include the restoration of agricultural land that is required temporarily for construction to agricultural use, and the handing back of land used temporarily to the original landowner. It is also assumed that buildings and other farm infrastructure on the land holding will not be replaced as this will ultimately be at the discretion of the landowner. For this reason, financial compensation is not a consideration in the assessment of effects on farm holdings, as set out under impacts on holdings below.

Environmental baseline

6.4.13 This section sets out the main baseline features that influence the agricultural use of land within the land required for the construction of the Proposed Scheme. These include the underlying soil resources that are used for food and biomass production, as well as providing other services and functions for society, and the associated pattern of agricultural and other rural land uses.

Soil and land resources

Soil parent materials

6.4.14 A full description of the geological characteristics of the Annandale area is provided in the water resources and flood risk section. This section only considers geology as a soil parent material, which is a soil-science name for a weathered rock or deposit from and within which a soil has formed[123]. The soil association developed in each parent material is identified below. The soil associations are described under 'Description and distribution of soil types' below.

6.4.15 The bedrock underlying the land required for the construction of the Proposed Scheme comprises sandstone in the St Bees Sandstone Member, which is part of the Chester Formation in the Sherwood Sandstone Group. The bedrock comprises reddish-brown, very fine to medium grained, commonly micaceous sandstones, which are generally cross-bedded, with some parallel lamination. Mudstone clasts are locally common, and there are subordinate thin beds of greenish grey sandstone.

6.4.16 Superficial deposits of glacial till in the Gretna Till Formation overlay the bedrock in various parts of the study area and provide the soil parent materials. The glacial till comprises reddish-brown clay.

Topography and drainage

6.4.17 Topography in this study area reflects the sandstone geology, into which the Kirtle Water has cut a broad valley floor. The highest ground occurs in the north-west at 40m above Ordnance Datum (AOD), with lower ground in the south-east at 35m AOD. The gradient of

[123] British Geological Survey. *Soil Parent Material Guide.* Available online at: Soil Parent Material Model - British Geological Survey (bgs.ac.uk).

the land is gentle to moderate, between two and seven degrees, and does not affect agricultural land quality.

6.4.18 The land required for the construction of the Proposed Scheme is not at risk of flooding by rivers[124]. It is drained by a number of watercourses and further details are provided in the water resources and flood risk assessment reported in this section.

Description and distribution of soil types

6.4.19 The broad characteristics of the soils are described by the James Hutton Institute and their general distribution is shown on the National Soil Map[125], which is replicated in Volume 5, Agriculture, Forestry and Soils Map Book, Map AG-02-803 Soil associations. The National Soil Map shows the location and extent of different soil associations. Each association represents a grouping of soils developed on similar parent materials.

6.4.20 The land required for the construction of the Proposed Scheme is exclusively made up of soils grouped in the Canonbie association. The most common type of soil in this association is the Canonbie series, which comprises imperfectly drained soils developed in reddish sandy clay loam or clay loam till. The topsoil is slightly stony, dark greyish-brown sandy silt loam, or occasionally sandy loam with moderate or strong subangular blocky structure. The subsoil consists of moderately stony reddish-brown clay loam or occasionally sandy clay loam. The fine textured and coarse structured subsoils are slowly permeable, and the land is prone to seasonal waterlogging (Wetness Class IV)[126].

Soil and land use interactions

Agricultural land quality

6.4.21 The principal soil/land use interaction is the quality of the agricultural land resource. The Land Capability Classification for Agriculture[127] is based on the identification of physical limitations to the agricultural capability of land resulting from the interactions of soil, climate, topography and drainage.

6.4.22 The main soil properties that affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. The climatic properties

[124] Scottish Environment Protection Agency (2019), *Flood Extent Map.* Available online at: http://map.sepa.org.uk/floodmap/map.htm.

[125] Scotland's soils – part of Scotland's environment (2017), *National Soil Map of Scotland 1:250,000 scale.* Available online at: https://soils.environment.gov.scot/maps/soil-maps/national-soil-map-of-scotland/.

[126] The Wetness Class of a soil is classified according to the depth and duration of waterlogging in the soil profile and has six categories from WC I which is well drained to WC VI which is permanently wet.

[127] Scotland's soils – part of Scotland's environment (2017), *National Scale Land Capability for Agriculture.* Available online at: https://soils.environment.gov.scot/maps/capability-maps/national-scale-land-capability-for-agriculture/.

that affect the cropping potential and management requirements of land are rainfall and temperature.

6.4.23 Relevant agro-climatic data given in the LCA guidelines[121] have been used in this assessment. In addition, local agro-climatic data have been interpolated from the Meteorological Office's standard 5km grid point dataset[128] for grid reference NY 29600 69800 at an altitude of 36m AOD. The average annual rainfall for this location is 983mm and the number of days the soil is predicted to be at field capacity is 233 field capacity days (FCD)[129].

6.4.24 Site factors such as gradient and microrelief[130] are not limiting to agricultural land quality within the study area.

6.4.25 The quality of agricultural land within the study area is not limited by the risk of flooding by rivers.

6.4.26 At a scale of 1:50,000[131], the published Land Capability Classification for Agriculture map shows the quality of agricultural land within the study area is classified as predominantly Land Capability Classification for Agriculture Class 3.2. There is some land in Class 3.1, which is in the Prime agricultural land category. The remainder of the agricultural land has been classified in Classes 4.1, 4.2, 5.2 and 6.2. The area and proportion of agricultural land quality in each LCA Class within the study area is shown in Table 16 .

6.4.27 As set out in the SMR, the sensitivity of prime agricultural land in the study area is determined relative to the abundance of such land in the locality, set as a 4km corridor centred on the route of the Proposed Scheme. From the published Land Capability Classification for Agriculture map[121], there is a low likelihood of encountering prime land 4km to the north of the Proposed Scheme, but there is a high likelihood of encountering prime land 4km to the south. Therefore, it is considered there is a moderate likelihood of encountering prime agricultural land in the locality overall, which makes such land a resource of medium sensitivity in the study area.

6.4.28 The distribution of agricultural land quality in the study area is shown in Table 16 as shown on Map AG-04-803 to Map AG-04-804 (Volume 5, Agriculture, Forestry and Soils Map Book).

[128] Meteorological Office (1989), *Gridpoint Meteorological data for Agricultural Land Classification of England and Wales and other Climatological Investigations*.

[129] Field Capacity Days (FCD) is a meteorological parameter which estimates the duration of the period when the soil moisture deficit is zero.

[130] Microrelief is the complex change of slope angle and direction over short distances, or the presence of boulders or rock outcrops, which can severely limit the use of agricultural machinery.

[131] The Macaulay Land Use Research Institute (1986), *Land Capability for Agriculture*. Carlisle and Solway Firth. Sheet 85. Scale 1:50,000.

Table 16: Distribution of LCA classes of agricultural land within the study area

LCA Class	Agricultural land within study area (ha)	Agricultural land within study area (%)
1	0	0
2	0	0
3.1	19.8	17.6
Prime agricultural land, i.e., Classes 1, 2 and 3.1 (Sub-total)	**19.8**	**17.6**
3.2	41.2	36.5
4.1	6.8	6.0
4.2	16.2	14.3
5.1	0	0
5.2	28.4	25.2
5.3	0	0
6.1	0	0
6.2	0.5	0.4
6.3	0	0
7	0	0
Total area	**112.9**	**100**

Other soil interactions

6.4.29 Soil fulfils a number of functions and services for society, in addition to those of food and biomass production, that are central to social, economic and environmental sustainability. These include:

- the storage, filtration and transformation of water, carbon and nitrogen in the biosphere;
- the support of ecological habitats, biodiversity and gene pools;
- support for the landscape;
- the protection of cultural heritage;
- the provision of raw materials; and
- the provision of a platform for human activities, such as construction and recreation.

Land use

Land use description

6.4.30 Agricultural land use within the study area is predominantly pasture, with occasional fields sown to arable crops. The land is mainly used to support cattle production, including dairy and beef, although there are also sheep and horses present. The majority of the grassland appears to be commercially managed, though some very wet poorer quality grassland is also present.

Number, type and size of holdings

6.4.31 The farm holdings within the study area and their sensitivity to change are identified in Table 17. The sensitivity of individual holdings to change is determined by the extent to which they have the capacity to absorb or adapt to impacts, which in turn is determined primarily by their nature and scale. In general terms, larger holdings have a greater capacity to change enterprise mix and scale, can better absorb impacts and are less sensitive. Units that rely on the use of buildings (such as intensive livestock and dairy farms, and horticultural units) are less able to accommodate change and have a higher sensitivity. Non-commercial land uses and units, such as pony paddocks associated with residential properties, have a low sensitivity. The holding reference provides a unique identifier and relates to maps AG-01-803 to AG-01-804 (Volume 5, Agriculture, Forestry and Soils Map Book).

Table 17: Summary characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Sensitivity to change
ADEP1 Floshend Farm *	Grassland	15	Not known	Medium
ADEP2 Cranberry Farm ¥	Beef and arable	93	None	Medium
ADEP3 Nouthill Farm including Williamsfield Farm ¥	Dairy and arable	120	None	Medium (dairy cows zero grazed so no reliance on grazing land)
ADEP4 Redhouse Farm ¥	Beef cattle	50	None	Medium
ADEP5 The Mill Forge ¥	Grassland	8.6	Hotel and wedding venue	Low
ADEP6 Land north-west of the West Coast Main Line (WCML)*	Grassland	7.0	Not known	Medium

¥ Although it has not been possible to arrange face-to-face farm impact assessment interviews with these holdings, telephone discussions have been held and brief baseline details have been obtained.

** It has not been possible to arrange farm impact assessment interviews with this holding and publicly available sources have been used to obtain the information presented.*

Future baseline

Construction (2025)

6.4.32 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2025.

6.4.33 No committed developments of relevance for agriculture, forestry and soil have been identified that would materially alter the future baseline in this area.

Operation (2038)

6.4.34 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2038.

6.4.35 No committed developments of relevance for agriculture, forestry and soil have been identified that would materially alter the future baseline in this area.

Effects arising during construction

Avoidance and mitigation measures

6.4.36 During the development of the design, the following measure has been incorporated to avoid or mitigate adverse severance impacts on land holdings: the agricultural access to Williamsfield Farm and Cranberry Farm will be maintained through the diversion of the existing access track (Volume 4, Off-route effects Map Book, Maps CT-06-805 and CT-06-806).

6.4.37 Other design refinements to reduce the impact of the Proposed Scheme on agriculture and soil resources include:

- rationalisation of balancing ponds to seek to locate them in the least sensitive agricultural locations;
- rationalisation of road realignments to reduce the area of agricultural land required; and
- rationalisation and relocation of mitigation planting to limit the area of agricultural land required and reduce impacts on holdings.

6.4.38 In addition, there is a need to avoid or reduce environmental impacts to soils during construction so that they will be in a suitable condition to support their proposed use for agricultural land, landscape planting and ecological mitigation following construction.

6.4.39 Compliance with the Code of Construction Practice (CoCP) [132] will avoid or reduce environmental impacts during construction. Those measures that are particularly relevant to agriculture and soils are set out in the draft CoCP and relate to:

[132] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

- the reinstatement of agricultural land that is used temporarily during construction to agriculture, where this is the agreed end use (Section 6);
- the provision of a method statement for stripping, handling, storing and replacing agricultural and woodland soils to reduce risks associated with soil degradation on areas of land to be returned to agriculture and woodland following construction, based on detailed soil survey work to be undertaken prior to construction. This will include any remediation measures necessary following the completion of works (Section 6);
- a requirement for contractors to monitor and manage flood risk and other extreme weather events, insofar as reasonably practicable, that may affect agriculture and soil resources during construction (Sections 5 and 16);
- arrangements for the maintenance of farm and field accesses affected by construction (Section 6);
- the protection and maintenance of existing land drainage and livestock water supply systems, where reasonably practicable (Sections 6 and 16);
- the protection of agricultural land adjacent to the construction site, including the provision and maintenance of appropriate stock-proof fencing (Sections 5, 6, 9 and 12);
- the adoption of measures to control the deposition of dust on adjacent agricultural crops (Section 7);
- the control of invasive and non-native species; and the prevention of the spread of weeds generally from the construction site to adjacent agricultural land (Section 9);
- the adoption of measures to prevent, insofar as reasonably practicable, the spread of soil-borne, tree, crop and animal diseases from the construction area (Sections 6 and 9); and
- liaison and advisory arrangements with affected landowners, occupiers and agents, as appropriate (Sections 5 and 6).

6.4.40 Upon completion of construction, soils replaced for agricultural or landscape uses will be monitored to identify and remediate any unsatisfactory growing conditions during the five-year aftercare period.

6.4.41 Where agricultural uses are to be resumed on land disturbed during the construction of the Proposed Scheme, the design objective is to avoid any reduction in long-term capability, which would downgrade the quality of the disturbed land, through the adoption of good practice techniques in handling, storing and reinstating soils on that land. The poorly or very poorly drained land with Canonbie association soils may also require particularly careful management. These management measures will be designed to address the timing of cultivation and livestock grazing during the aftercare period to ensure this outcome.

6.4.42 HS2 Ltd will continue to work with affected parties and stakeholders to identify reasonably practicable mitigation measures where appropriate.

Assessment of impacts and effects

6.4.43 The acquisition and use of land for the Proposed Scheme will interfere with the existing uses of that land, and in some locations preclude existing land uses or sever and fragment individual fields and operational units of agricultural land. This could result in potential effects associated with the ability of affected agricultural interests to access and effectively use residual parcels of land. There may also be the loss of, or disruption to, buildings and operational infrastructure such as drainage. The Proposed Scheme seeks to reduce this disruption, and where appropriate and reasonably practicable, incorporate residual parcels of land no longer effective for agricultural use due to their size and/or shape as part of environmental mitigation works, such as ecological habitat creation.

6.4.44 Land used to construct the Proposed Scheme will fall into the following main categories when work is complete:

- Annandale depot and associated works and kept under the control of the operator;
- highway, public rights of way or utility diversion/realignment;
- returned to agricultural use (with aftercare management to ensure stabilisation of the soil structure);
- used for drainage and balancing ponds; or
- used for ecological and/or landscape mitigation.

Temporary effects during construction

Impacts on agricultural land

6.4.45 During the construction phase, the total area of agricultural land required for the Proposed Scheme will be approximately 113ha as shown in Table 18. Of this total, it is anticipated that approximately 76ha will be restored and available for agricultural use following construction.

Table 18: Agricultural land required for the construction of the Proposed Scheme

Class	Area required (ha)	Percentage of agricultural land (%)	Area to be restored (ha)
1	0	0	0
2	0	0	0
3.1	19.8	17.6	14.2
Prime agricultural land, i.e., Classes 1, 2 and 3.1 (Sub-total)	**19.8**	**17.6**	**14.2**
3.2	41.2	36.5	27.5
4.1	6.8	6.0	4.9
4.2	16.2	14.4	8.3
5.1	0	0	0
5.2	28.4	25.2	20.4
5.3	0	0	0

Class	Area required (ha)	Percentage of agricultural land (%)	Area to be restored (ha)
6.1	0	0	0
6.2	0.5	0.3	0.5
6.3	0	0	0
7	0	0	0
Total area	**112.9**	**100**	**75.8**

6.4.46 The disturbance during construction to approximately 20ha of prime agricultural land comprising 18% of the agricultural land requirement, is assessed as an impact of low magnitude. Prime agricultural land is assessed as a receptor of medium sensitivity because of its moderate abundance in this locality. The effect of the Proposed Scheme on prime agricultural land during the construction phase is, therefore, assessed as minor adverse, which is not significant.

Impacts on soils

6.4.47 In areas of heaviest rainfall, and during the wettest times of the year, soils with high clay and silt fractions are most susceptible to the effects of handling during construction and the re-instatement of land; whereas soils with a high sand fraction in areas of lowest rainfall and during the driest times of the year are the least susceptible.

6.4.48 Successful soil handling is dependent upon movements being undertaken under appropriate weather and ground conditions using the appropriate equipment. The principles of soil handling are well established and set out in advisory material such as the Department for Environment, Food and Rural Affairs (Defra) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites[133] (the policy section is not relevant for Scotland). These principles will be followed throughout the construction period.

6.4.49 Implementation of the measures set out in the draft CoCP will ensure displaced soil mostly fulfils its pre-existing functions on-site, which are production of food, and providing ecological habitat resulting in an impact of low magnitude on the displaced soils. The sensitivity of the majority of soil within the study area on land in Class 3.2 or below is medium, and therefore, the significance of the effect will be minor adverse, which is not significant.

Impacts on holdings

6.4.50 Land will be required for the Proposed Scheme from holdings temporarily, during the construction period, or permanently. In most cases, the temporary and permanent land requirement will occur simultaneously at the start of the construction period and it is the

[133] Department for Environment, Food and Rural Affairs (2009), *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.* Available online at: https://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites.

combined effect of both that will have the most impact on the holding. During the construction period, some agricultural land will be restored and the impact on individual holdings will reduce.

6.4.51 The effects of the Proposed Scheme on individual agricultural and related interests during the construction period are summarised in Table 19. The table shows the total area of land required from a particular holding in absolute terms and as a percentage of the total area farmed. It also shows the area of land that could be returned to the holding following the construction period. The degree of impact is based on the proportion of the holding required rather than the absolute area of land.

6.4.52 The effects of severance during construction are judged on the ease and availability of access to severed land. The disruptive effects, principally of construction noise and dust, are assessed according to their effects on land uses and enterprises. Impacts on residential properties on farm holdings are assessed, as required, in the air quality, sound, noise and vibration and landscape and visual assessments.

6.4.53 The potential scale of effect is determined by combining the highest impact on the farm holding with the sensitivity of that holding, as set out in the SMR.

Table 19: Summary of temporary impacts and effects on holdings from construction

Holding reference/name	Sensitivity to change	Total area required from holding	Construction severance	Disruption	Scale of construction effect	Area to be restored
ADEP1 Floshend Farm	Medium	3.1ha (21%) High	Negligible	Negligible	Major/ moderate adverse due to the proportion of land required	2.5ha
ADEP2 Cranberry Farm	Medium	30.7ha (33%) High	Medium	Negligible	Major/ moderate adverse due to the proportion of land required	22.2ha
ADEP3 Nouthill Farm including Williamsfield Farm	Medium	22.3ha (19%) Medium	Medium	Negligible	Moderate adverse due to the proportion of land required and severance	12.3ha
ADEP4 Redhouse Farm	Medium	35.4ha (71%) High	Negligible	Low	Major/ moderate adverse due to the proportion of land required	22.2ha

Holding reference/name	Sensitivity to change	Total area required from holding	Construction severance	Disruption	Scale of construction effect	Area to be restored
ADEP5 The Mill Forge	Low	5.7ha (66%) High	Negligible	Negligible	Moderate adverse due to the proportion of land required	1.9ha
ADEP6 Land north-west of the WCML	Medium	0.3ha (<5%) Negligible	Negligible	Negligible	Negligible	0.3ha

6.4.54 Overall, six holdings in the study area will be affected during construction, of which five will experience moderate or major/moderate adverse temporary effects, which are significant for each holding.

6.4.55 Although financial compensation will be available under existing statutory arrangements to offset these impacts, it is not a consideration in the assessment of environmental effects on farm holdings.

Permanent effects of construction

Impacts on agricultural land

6.4.56 Following construction and restoration, the area of land that will remain permanently required will be approximately 37ha, as shown in Table 20.

Table 20: Agricultural land required permanently

Agricultural land quality	Total area required (ha)	Percentage of agricultural land (%)
1	0	0
2	0	0
3.1	5.6	15.2
Prime agricultural land, i.e., Classes 1, 2 and 3.1 (Sub-total)	**5.6**	**15.2**
3.2	13.6	36.8
4.1	1.8	5.0
4.2	7.9	21.3
5.1	0	0
5.2	8.0	21.7
5.3	0	0
6.1	0	0
6.2	0	0
6.3	0	0
7	0	0
Total area	**36.9**	**100**

6.4.57 The permanent requirement for approximately 6ha of prime agricultural land comprising 15% of the agricultural land requirement, is assessed as an impact of low magnitude. Prime agricultural land is assessed as a receptor of medium sensitivity because of its scarcity in this locality. The permanent effect on prime agricultural land is, therefore, assessed as minor adverse, which is not significant.

Impacts on holdings

6.4.58 The permanent effects from the construction of the Proposed Scheme on individual agricultural and related interests are summarised in Table 21. The land required from holding column refers to the area of land required for the operation of the Proposed Scheme in absolute terms and as a percentage of the overall area farmed. The scale of impact is based on the likely proportion of land required from the holding. The effects of severance are judged on the ease and availability of access to severed land once construction is completed. The impact on farm infrastructure refers mainly to the loss of or damage to farm capital, such as property, buildings and structures, and the consequential effects on land uses and enterprises.

6.4.59 The potential scale of effect is determined by combining the highest impact on the farm holding with the sensitivity of that holding, as set out in the SMR.

Table 21: Summary of permanent impacts and effects on holdings from construction

Holding reference/ name	Sensitivity to change	Land required from holding	Severance	Infrastructure	Scale of construction effect
ADEP1 Floshend Farm	Medium	0.7ha (4%) Negligible	Negligible	Negligible	Negligible
ADEP2 Cranberry Farm	Medium	8.5ha (9%) Low	Negligible	Negligible	Minor adverse
ADEP3 Nouthill Farm including Williamsfield Farm	Medium	10.0ha (8%) Low	Medium	Negligible	Moderate adverse due to severance
ADEP4 Redhouse Farm	Medium	13.2ha (26%) High	Negligible	Negligible	Major/moderate adverse due to the proportion of land required
ADEP5 The Mill Forge	Low	3.8ha (44%) High	Negligible	Negligible	Moderate adverse due to the proportion of land required
ADEP6 Land north-west of the WCML	Medium	0.0ha (0%) Negligible	Negligible	Negligible	Negligible

6.4.60 Overall, the construction of the Proposed Scheme will affect five holdings in the study area permanently, with three holdings experiencing moderate or major/moderate adverse permanent effects, which are significant for each holding. One holding will be affected only temporarily during construction.

6.4.61 Although financial compensation will be available under existing statutory arrangements, there can be no certainty that this will be used to reduce the above adverse effects by the purchase of replacement land or the construction of replacement buildings. Therefore, the above assessment should be seen as the worst-case, which could be reduced if the owner and/or occupier is able, and chooses, to use compensation payments to replace assets.

Other mitigation measures

6.4.62 Other mitigation will incorporate climate change adaptation and resilience measures, insofar as reasonably practicable. For example, restored soils in areas that could be prone to drought with climate change could potentially be replaced at greater depths than at present to make them resilient to drought.

6.4.63 A farm pack within the Phase 2b Farmers and Growers Guide will be provided to all directly affected farmers and landowners, setting out baseline conditions on the land holding and the assurances and obligations that HS2 Ltd will accept upon entering the land. This will include advice and appropriate assistance where there is a need for the landowner to relocate or re-provide agricultural buildings displaced by the Proposed Scheme.

Summary of likely residual significant effects

6.4.64 Six holdings will be affected temporarily, of which five will experience temporary moderate or major/moderate residual effects, which are significant for each holding. Five of these holdings will also be affected permanently with three experiencing moderate or major/moderate permanent effects following construction, which is significant for each holding.

Cumulative effects

6.4.65 There are no cumulative effects identified as arising from the construction of the Proposed Scheme as a consequence of other development projects affecting agricultural land in the locality.

Effects arising from operation

Avoidance and mitigation measures

6.4.66 No measures are required to mitigate the operational effects of the Proposed Scheme on agriculture and soils.

Assessment of impacts and effects

6.4.67 Potential impacts arising from the operation of the Proposed Scheme will include:

- noise emanating from moving trains; and
- the propensity of operational land to harbour noxious weeds.

6.4.68 No farm livestock buildings lie within 100m of the Proposed Scheme and therefore, in line with the specific criteria defined in the agriculture, forestry and soils section of the SMR, no likely significant effects from noise on livestock are identified.

Other mitigation measures

6.4.69 No other mitigation measures have been identified.

Summary of likely residual significant effects

6.4.70 No residual significant effects on agriculture or soils have been identified as a result of the operation of the Proposed Scheme.

Cumulative effects

6.4.71 There are no cumulative effects identified as arising from the operation of the Proposed Scheme as a consequence of other development projects affecting agriculture or soils in the study area.

Monitoring

6.4.72 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.4.73 On the basis of there being no significant residual operational effects, there are no area-specific requirements for monitoring agriculture, forestry and soil effects during the operation of the Proposed Scheme in the study area.

6.5 Air quality

Introduction

6.5.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction and operation of the Proposed Scheme within the Annandale area. Oxides of nitrogen (NO_x) including nitrogen dioxide (NO_2), fine particulate matter (particles of size less than 2.5µm and 10µm in diameter, referred to as $PM_{2.5}$ and PM_{10}, respectively) and dust have been considered in the assessment. Emissions of all or some of these air pollutants are likely to arise from construction activities, demolition, site preparation works and the use of construction traffic routes. Emissions will also arise from road traffic during construction and operation of the Proposed Scheme.

6.5.2 Engagement with Dumfries and Galloway Council (DGC) has been undertaken. The purpose of this engagement has been to obtain relevant baseline information, which includes monitoring data in this area.

6.5.3 Detailed reports on the air quality data and assessments for this area are contained within Volume 5: Appendix AQ-001-OR003. Additional information on air quality monitoring and traffic data used in the assessment is set out in Background Information and Data (BID), BID AQ-002-OR003[134].

6.5.4 Maps showing the location of the key environmental features and the key construction and operational features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 6.1.

6.5.5 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

6.5.6 The scope, assumptions and limitations for the air quality assessment are set out in Volume 1, Introduction and methodology, Section 8, the EIA Scope and Methodology Report (SMR)[135] and Volume 5: Appendix AQ-001-OR003.

6.5.7 The study areas for the air quality assessment have been determined on the basis of where impacts on local air quality may occur:

- from construction activities;
- from changes in the nature of traffic during construction and operation; for example, increases in traffic flows during construction or where road closures or restrictions cause diversions and heavier traffic on adjacent roads; or
- from changes to road alignment.

6.5.8 The assessment of construction dust emissions has been undertaken for sensitive receptors located up to 350m from dust generating activities. The assessment of traffic emissions has been undertaken for sensitive receptors located up to 200m from roads screened in for further assessment.

6.5.9 The assessment has incorporated HS2 Ltd's policies on vehicle emissions[136]. These include the use of Euro VI heavy goods vehicles (HGV), Euro 4 petrol and Euro 6 diesel cars and light goods vehicles (LGV) during construction of the Proposed Scheme.

6.5.10 The assessment of construction traffic impacts has used traffic data based on an estimate of the average daily flows in the peak year during the construction period. The assessment assumes vehicle emission rates and background pollutant concentrations from year 2025, as

[134] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[135] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

[136] High Speed Two Ltd (2022), *HS2 Phase 2b Western Leg Information Paper E14: Air quality*.

the first year of construction for the full Proposed Scheme as set out in Volume 1, Introduction and methodology. As both pollutant emissions from vehicle exhausts and background pollutant concentrations are anticipated to reduce year by year as a result of vehicle emission controls, the year 2025 represents the worst case for the construction assessment.

Environmental baseline

Existing baseline

Background air quality

6.5.11 The main sources of air pollution in the Annandale area are emissions from road vehicles and agricultural activities. The main roads within the area are the A74(M) and the B7076.

6.5.12 There are no industrial installations (regulated by the Scottish Environment Protection Agency (SEPA)) with permits for emissions to air. The contribution of all industrial processes and other emission sources to local air quality is included within the background concentrations.

6.5.13 Estimates of background air quality have been taken from the Department for Environment, Food and Rural Affairs (Defra)[137] for the baseline year of 2018. The data are estimated for 1km grid squares for NO_x, NO_2, PM_{10} and $PM_{2.5}$. Background concentrations were within the air quality standards for all pollutants within the Annandale area.

Local monitoring data

6.5.14 There is currently one local authority diffusion tube site located within 2km of the Annandale area for monitoring NO_2 concentrations, located along the B7076 at Gretna Loaning. Measured concentrations in 2018 were within the air quality standard.

6.5.15 The monitoring data are presented in Volume 5: Appendix AQ-001-OR003 and BID AQ-002-OR003.

Air quality management areas

6.5.16 There are no air quality management areas (AQMA) within the DGC area.

Receptors

6.5.17 Several locations have been identified in the area as sensitive receptors, which are considered to be susceptible to changes in air quality due to their proximity to dust generating activities or traffic routes during construction or operation of the Proposed Scheme.

[137] Department for Environment, Food and Rural Affairs (Defra), *Defra Background Pollutant Concentration Maps*. Available online at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018.

6.5.18 Most of the receptors which may be affected by the Proposed Scheme are residential.

6.5.19 The air quality assessment has also included receptors in ecological sites sensitive to nitrogen deposition and dust. There are no international/national designated ecological sites of relevance to the air quality assessment identified in the Annandale area. Other relevant local sensitive ecological sites identified close to the Proposed Scheme include the following ancient woodland sites: Blacksike Wood and Bensmoor Wood, unnamed woodland east of Railway Cottage, unnamed woodland south of Railway Cottage and Mossknowe Lodge Wood. Potential ancient woodland sites include plantation east of Nook Cottage, Billy's Wood and Manse Wood.

Future baseline

6.5.20 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to be implemented prior to construction. The potential cumulative impact from committed developments on air quality in conjunction with the effects from the construction and operation of the Proposed Scheme has been considered as part of this assessment. The future air quality baselines are defined as the 'without the Proposed Scheme' scenarios at each stage.

Construction (2025)

6.5.21 Future background pollutant concentrations have been sourced from the Defra background maps for the first year of construction in 2025, which predict NO_2, PM_{10} and $PM_{2.5}$ levels in 2025 to be lower than in the 2018 baseline and within the relevant air quality standards.

6.5.22 Committed developments that have been included as future receptors in the assessment of air quality impacts during construction of the Proposed Scheme are identified in Volume 5: Appendix AQ-001-OR003. No additional committed developments have been identified in this study area that will materially alter the baseline conditions in 2025 for air quality.

Operation (2038)

6.5.23 Future background pollutant concentrations have been sourced from the Defra background maps for 2038, which predict NO_2, PM_{10} and $PM_{2.5}$ levels in 2038 to be lower than in the 2018 baseline and within the relevant air quality standards.

6.5.24 Committed developments that have been included as future receptors in the assessment of air quality impacts during operation of the Proposed Scheme are identified in Volume 5: Appendix AQ-001-OR003. No additional committed developments have been identified in this study area that will materially alter the baseline conditions in 2038 for air quality.

Effects arising during construction

Avoidance and mitigation measures

6.5.25 Emissions to the atmosphere will be controlled and managed during construction through the route-wide implementation of the Code of Construction Practice (CoCP). The draft CoCP[138] includes a range of mitigation measures that are accepted by the Institute of Air Quality Management (IAQM) as being suitable to reduce impacts to as low a level as is reasonably practicable. These measures are generally sufficient to avoid any significant effects from dust during construction.

6.5.26 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP will be implemented. These include:

- contractors being required to manage dust, air pollution, odour and exhaust emissions during construction works;
- inspection and visual monitoring, undertaken in consultation with the local authorities, to assess the effectiveness of the measures taken to control dust and air pollutant emissions;
- cleaning (including watering) of vehicle routes and designated vehicle waiting areas to suppress dust;
- keeping soil stockpiles away from sensitive receptors where reasonably practicable, also taking into account the prevailing wind direction relative to sensitive receptors;
- the use of enclosures to contain dust emitted from construction activities; and
- soil spreading, seeding and planting of completed earthworks as soon as reasonably practicable following completion of earthworks.

6.5.27 The draft CoCP includes the requirement for site-specific traffic management measures, such as the use of site haul routes for construction vehicles to minimise the need to use public roads.

6.5.28 Prior to commencement of activities, there will be further detailed assessment for each worksite to determine site specific dust mitigation.

Assessment of impacts and effects

Temporary effects

6.5.29 Impacts from construction of the Proposed Scheme could arise from dust generating activities and emissions from construction traffic. As such, the assessment of construction impacts has been undertaken for dust and exposure to NO_2, PM_{10} and $PM_{2.5}$ concentrations.

[138] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

Construction dust effects

6.5.30 The risks of earthworks, construction of new structures and trackout have been assessed for their effect on dust soiling, human health[139] and ecological sites. Trackout refers to the transport of dust and dirt from the construction site(s) onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The human health effects of dust relate mainly to short-term exposure to PM_{10}.

6.5.31 The identified risks potentially arising from construction dust within the Annandale area are shown in Table 22. The risks are dependent on the magnitude of dust generating activities and the location of sensitive receptors in relation to these activities.

Table 22: Summary of risks for construction dust assessment

Activity	Dust soiling	Human health	Ecological effects
Demolition	Not applicable	Not applicable	Not applicable
Earthworks	High	Low	Low
Construction	High	Low	Low
Trackout	Medium	Low	Low

6.5.32 With the application of the established national best practice mitigation measures contained in the draft CoCP, no significant effects are anticipated from the risks associated with the dust generating activities. Further details of the assessment can be found in Volume 5: Appendix AQ-001-OR003 where the scale of dust emissions and the sensitivity of the area and receptors are fully described.

Construction traffic effects

6.5.33 Construction activity could also affect local air quality through the additional traffic generated on the highway network and construction traffic routes as a result of construction vehicles, and through changes to traffic patterns arising from temporary road diversions and realignments.

6.5.34 The assessment of construction traffic emissions has been undertaken for a 'without the Proposed Scheme' scenario and a 'with the Proposed Scheme' scenario. The traffic data for each scenario includes the additional traffic from future committed developments.

6.5.35 Construction traffic data in the study area have been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads during construction of the Proposed Scheme. This comprises the Annandale depot main compound access road.

[139] Human health effects relate mainly to short-term exposure to particles of size between 2.5µm to 10µm, measured as PM_{10}.

6.5.36 No designated ecological receptors of relevance to the construction phase air quality assessment have been identified within 200m of the screened in roads in the area. No further assessment of ecological receptors was therefore required for this area.

6.5.37 Receptors expected to experience the greatest change in concentrations have been included in the air quality model. No significant effects are predicted at any sensitive receptors during construction of the Proposed Scheme. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ are within the relevant air quality standards both with and without the Proposed Scheme.

Permanent effects

6.5.38 No permanent effects on local air quality are likely to arise during construction of the Proposed Scheme.

Other mitigation measures

6.5.39 No other mitigation measures are considered necessary in relation to air quality during construction of the Proposed Scheme in this area.

Summary of likely residual significant effects

6.5.40 The methods outlined within the draft CoCP are considered effective at reducing dust and traffic emissions, and therefore, no significant residual effects are anticipated.

Cumulative effects

6.5.41 The data used in the air quality assessment take account of predicted changes in traffic as a result of committed developments in the area, and therefore, their impacts have been included within the assessment. It is assumed that dust emissions from construction of other developments in the area will be controlled by appropriate measures as set out within their respective environmental management controls, and therefore, no cumulative effects for air quality are anticipated.

Effects arising from operation

Avoidance and mitigation measures

6.5.42 No specific mitigation measures for air quality are proposed during operation of the Proposed Scheme.

Assessment of impacts and effects

6.5.43 Impacts from the operation of the Proposed Scheme will arise from changes in the volume, composition and/or speed of road traffic and changes in road alignment.

6.5.44 There will be no direct atmospheric emissions from the operation of trains that will cause an impact on air quality, and therefore, no assessment is required. Indirect emissions from sources such as rail and brake wear have been assumed to be negligible.

Operational traffic effects

6.5.45 The assessment of operational traffic emissions has been undertaken for a 'without the Proposed Scheme' scenario and a 'with the Proposed Scheme' scenario in 2038. The traffic data for each scenario include the additional traffic from future committed developments.

6.5.46 Traffic data in the study area have been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads during operation of the Proposed Scheme. This comprises the Annandale depot access road.

6.5.47 No designated ecological receptors of relevance to the operational phase air quality have been identified within 200m of the screened in roads in the area. No further assessment of ecological receptors was therefore required for this area.

6.5.48 Receptors expected to experience the greatest change in concentrations have been included in the air quality model. No significant effects are predicted at any modelled receptors during operation of the Proposed Scheme. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ are within the relevant air quality standards both with and without the Proposed Scheme.

Other mitigation measures

6.5.49 No other mitigation measures are proposed in relation to air quality during operation of the Proposed Scheme.

Summary of likely residual significant effects

6.5.50 No significant residual effects are anticipated for air quality in this area during operation of the Proposed Scheme.

Cumulative effects

6.5.51 The data used in the air quality assessment take account of predicted changes in traffic as a result of committed developments in the area, and therefore, their impacts have been included within the assessment.

Monitoring

6.5.52 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.5.53 On the basis of there being no significant residual operational effects, there are no area-specific requirements for monitoring air quality effects during operation of the Proposed Scheme in the Annandale area.

6.6 Ecology and biodiversity

Introduction

6.6.1 This section of the report describes the ecological baseline and identifies the predicted impacts and likely significant effects on habitats and species that will arise from construction and operation of the Proposed Scheme in the Annandale area. This includes effects on sites recognised or designated on the basis of their importance for nature conservation.

6.6.2 Engagement has been undertaken with stakeholders including Dumfries and Galloway Council (DGC), NatureScot, the Scottish Environment Protection Agency (SEPA), Scottish Forestry and South West Scotland Environmental Information Centre. The purpose of this engagement has been to obtain relevant baseline information and inform the design development and assessment of the Proposed Scheme.

6.6.3 Volume 5 contains supporting information to the ecological assessment reported in this section, including:

- ecological baseline data – designated sites (see Volume 5: Appendix EC-001-OR003);
- an ecological register of significant effects below local level, which are not reported individually in Volume 4 (see Volume 5: Appendix EC-003-OR003); and
- document to inform a Habitats Regulations Appraisal (HRA) Screening Report and Appropriate Assessment for the Solway Firth Special Protection Area (SPA), Upper Solway Flats and Marshes Ramsar site and Solway Firth Special Area of Conservation (SAC) (see Volume 5: Appendix EC-004-OR003).

6.6.4 Due to map scale, statutory designated sites are not shown on Map Series EC-01, but figures showing the distribution of statutory designated sites are contained within the document to inform an HRA Screening Report and Appropriate Assessment for the Solway Firth SPA, Upper Solway Flats and Marshes Ramsar site and Solway Firth SAC (see Volume 5: Appendix EC-004-OR003).

6.6.5 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 6.1.

6.6.6 In addition, ecological baseline information relating to habitats and species recorded in the Annandale area is set out in Background Information and Data (BID)[140] (BID EC-002-OR003) and displayed in Volume 5, Ecology Map Book, Map Series EC-02.

6.6.7 All distances, lengths and area measurements in this section are approximate.

[140] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

Scope, assumptions and limitations

6.6.8 The scope, assumptions and limitations for the ecological assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report (SMR)[141] and in the Field Survey Methods and Standards (FSMS), which is included in the SMR.

6.6.9 A Water Framework Directive (WFD) compliance assessment has been undertaken in conjunction with the environmental assessment (see the water resources and flood risk assessment). Details of the assessment are set out in Volume 5: Appendix WR-003-OR003.

6.6.10 Baseline data to inform the assessment are largely limited to publicly available data. Therefore, a precautionary approach has been applied whereby the assessment has been undertaken using appropriate sources of information and professional judgement.

6.6.11 Where the assessment has been based upon limited data, the relevant ecological receptor is described as 'of up to' a specific value to indicate that a precautionary approach has been applied.

6.6.12 The precautionary approach to the assessment that has been adopted identifies the likely significant ecological effects of the Proposed Scheme. Unless otherwise stated, the description of effects assumes that land required for the construction of the Proposed Scheme will be subject to habitat loss, with the land required for construction purposes only being reinstated following completion of construction. This includes areas identified specifically for habitat creation. With respect to overhead utility diversions/realignments in particular, it is likely that the majority of the habitats within the land required for the construction of the Proposed Scheme can in fact be retained, and that the land is only required to allow for raising or lowering of pylons and/or re-stringing of cables, or to provide an access route to the works. Specifically, the land required for the construction of the Proposed Scheme includes a small section of Gretna Flow to provide a working area for oversailing purposes only.

Environmental baseline

Existing baseline

Introduction

6.6.13 This section describes the ecological baseline relevant to the assessment: the designated sites, habitats and species recorded in the Annandale area. Further details are provided in the reports presented in Volume 5: Appendix EC-001-OR003 and BID: BID EC-002-OR003, and maps presented in Volume 5, Map Series EC-01 and EC-02.

[141] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

6.6.14 Land adjacent to and required for the construction of the Proposed Scheme in the Annandale area consists mainly of agricultural land comprising grassland and arable fields separated by hedgerows (some containing trees) and a network of small drains. The Ewes Burn flows through the land required for the construction and operation of the Proposed Scheme and extends to the south crossing below the B7076. Woodland is present in small parcels near to the junction between the A74(M) and the B7076, to the north of the existing railway, and to the south of the Ewes Burn adjacent to the B7076.

Designated sites

6.6.15 There are four statutory designated sites of international importance of potential relevance to the assessment in the Annandale area, one of which, the Solway Firth, has overlapping designations (SPA, SAC and Ramsar). They are:

- Raeburn Flow SAC, covering an area of 64.2ha, is designated for the Annex I[142] habitats present; active raised bog, and degraded raised bog still capable of regeneration. The SAC is located 1.1km to the north of the land required for the construction of the Proposed Scheme;
- Solway Firth SPA, covering 1,375km2 of the Solway Firth Estuary, is designated for populations of birds of European importance of the following overwintering species: red throated diver, whooper swan, barnacle goose, golden plover, bar-tailed godwit, pink-footed goose, pintail, scaup, oystercatcher, knot, curlew, and redshank, and ringed plover on passage. In addition, the SPA supports a bird assemblage of international importance, regularly supporting 133,222 individual wildfowl (five-year peak mean 1991/2 to 1995/6). The SPA is located 2.6km to the south of the land required for the construction of the Proposed Scheme;
- Upper Solway Flats and Marshes Ramsar site, covering 43,676ha, is designated for the large assemblage of wintering birds, and individual species listed above with respect to the SPA designation, and also greater scaup. The Ramsar site is also designated because it supports over 10% of the British population of natterjack toad. The Ramsar site is located 2.6km to the south of the land required for the construction of the Proposed Scheme; and
- Solway Firth SAC, covering 43,676ha, is designated for the Annex I habitats present. This includes sandbanks which are slightly covered by seawater all the time, estuaries, mudflats and sandflats not covered by seawater at low tide, *Salicornia* species and other annuals colonising mud and sand, and Atlantic salt meadows. In addition, the following habitats are present as qualifying features, but not a primary reason for selection: reefs, perennial vegetation of stony banks, and fixed coastal dunes with herbaceous vegetation ('grey dunes'). Sea lamprey and river lamprey are Annex II[143] species which are also a

[142] Annex I of the EU's Habitats Directive (1992) lists key habitat types whose conservation requires the designation of Special Areas of Conservation.

[143] Species for which sites can be designated under the Habitats Directive are listed on Annex II of the EU Habitats Directive.

primary reason for selection of this site. The SAC is located 2.6km to the south of the land required for the construction of the Proposed Scheme.

6.6.16 There are two nationally important Sites of Special Scientific Interest (SSSI) that are of potential relevance to the assessment in the Annandale depot area. These are:

- Raeburn Flow SSSI, covering an area of 64.0ha[144], is designated for the relatively undisturbed lowland raised bog (as in the overlapping SAC designation described above). The SSSI is located 1.1km to the north of the land required for the construction of the Proposed Scheme; and
- Upper Solway Flats and Marshes SSSI, covering an area of 43,368ha spanning Cumbria and Dumfries and Galloway, represents one of the largest continuous areas of intertidal habitat in Britain. It is a component of the Solway Firth SAC, Upper Solway Flats and Marshes Ramsar site, and Solway Firth SPA described above. The estuarine complex is of national and international importance for the wintering wildfowl and wading birds, and migratory species. The SSSI is also noted for its populations of breeding birds, natterjack toads and invertebrates, and a number of rare plants. The SSSI is located 2.6km to the south of the land required for the construction of the Proposed Scheme.

6.6.17 The Scottish Ancient Woodland Inventory (AWI) dataset represents a provisional guide to the location of ancient woodland in Scotland, which is derived from the Roy maps (c1750) and the Ordnance Survey (OS) 1st edition (c1860). There are five areas of ancient woodland of potential relevance to the assessment in the Annandale area which are of national value. They are:

- Blacksike Wood and Bensmoor Wood, 6.8ha in area, comprising long-established (or plantation origin) woodland and located adjacent to land required for the construction of the Proposed Scheme, either side of the West Coast Main Line (WCML) at Quintinshill railway bridge;
- woodland east of Grahamshill Railway Cottages, 1.2ha in area, comprising long-established (or plantation origin) woodland and located adjacent to land required for the construction of the Proposed Scheme, to the north of the WCML at Whinnyrig;
- woodland south of Grahamshill Railway Cottages, 0.2ha in area, comprising long-established (or plantation origin) woodland and located within the land required for the construction of the Proposed Scheme to the south of the WCML;
- Mossknowe Lodge Wood, comprising multiple small components, 0.7ha in area, comprising long-established (or plantation origin) woodland and located adjacent to land required for the construction of the Proposed Scheme alongside the existing B7076; and
- Cove Wood, 48ha in area comprising ancient (of semi-natural origin) woodland located 210m south of the land required for construction of the Proposed Scheme, to the south of the WCML.

[144] SiteLink (2020), *Upper Solway Flats and Marshes SSSI.* Available online at: https://sitelink.nature.scot/site/1583.

6.6.18 A heritage review was undertaken by HS2 Ltd to evaluate the distribution of ancient and potential ancient woodland of relevance to the assessment in the Annandale area. Potential ancient woodland referenced in this report is land that is currently wooded and appears to have been continually wooded, since at least 1750, outwith the AWI. The heritage review considered the AWI, the native woodland survey of Scotland and freely available aerial photography.

6.6.19 Four potential ancient woodlands are of relevance to the assessment in the Annandale area:

- plantation east of Nook Cottage, 0.6ha in area, comprising long-established (or plantation origin) woodland adjacent to land required for the construction of the Proposed Scheme alongside the B7076;
- Billy's Wood, 0.7ha in area, comprising semi-natural woodland and located adjacent to land required for construction of the Proposed Scheme, to the north of the WCML;
- Manse Wood, 0.1ha in area and located 48m south of the land required for construction of the Proposed Scheme, to the south of the WCML and Kirkpatrick-Fleming; and
- Kirkpatrick Burn Wood, 0.2ha in area and located 55m south of the land required for construction of the Proposed Scheme, to the south of the WCML and Kirkpatrick-Fleming.

6.6.20 Ancient woodland and potential ancient woodland are shown on Map Series EC-01 in the Volume 5, Ecology Map Book.

6.6.21 Areas of woodland comprising predominantly broadleaved tree species are likely to qualify as a conservation priority of the Dumfries and Galloway Biodiversity Action Plan[145] (BAP), which lists habitat action plans for all of the main types of native woodland in the county. They are also likely to represent woodland types listed on the Scottish Biodiversity List[146].

Habitats

6.6.22 In addition to the woodlands identified above, the following habitat types that occur in this area are relevant to the assessment.

Woodland

6.6.23 There is one other area of woodland that qualifies or is likely to qualify as lowland mixed deciduous woodland, a habitat of principal importance on the Scottish Biodiversity List. This is an unnamed woodland, 1.2ha in area, comprising semi-natural woodland located adjacent

[145] Dumfries and Galloway Biodiversity Partnership (2009), *Dumfries and Galloway Biodiversity Action Plan.* Available online at: https://www.dumgal.gov.uk/media/19945/Local-Biodiversity-Action-Plan/pdf/Local_Biodiversity_Action_Plan.pdf.

[146] The Scottish Biodiversity List is a tool to help public bodies carry out their Biodiversity Duty. Scottish Ministers first published the List in 2005 to meet the requirements of Section 2(4) of The Nature Conservation (Scotland) Act 2004. Available online at: https://www.nature.scot/sites/default/files/2020-08/Scottish%20Biodiversity%20List.xls.

to the west of land required for construction of the Proposed Scheme and to the south of the WCML.

Grassland

6.6.24 Semi-improved grassland, covering an area of 9.4ha, and marshy grassland, covering an area of 8.6ha, occurs within land required for the construction of the Proposed Scheme. This is, at least in part, managed for stock grazing. In the absence of detailed survey information, this grassland is assumed to be of up to local value.

6.6.25 Gretna Flow, covering an area of 14ha is located partially within the land required for the construction of the Proposed Scheme to the north-east. This land is identified on OS mapping and, based on aerial photography assumed to comprise semi-improved acid grassland, parts of which may be species-rich and qualify as a habitat of principal importance. In the absence of detailed survey information, on a precautionary basis this grassland is of up to county value.

Hedgerows

6.6.26 In total, there is 10.1km of hedgerow within the land required for the construction of the Proposed Scheme in the Annandale area. None of the hedgerows have been subject to survey, but aerial photography indicates that the majority of hedgerows are field boundaries, closely managed and often coupled with stock-proof fencing. From aerial photography, several of the hedgerows also contain mature trees. On a precautionary basis and in the absence of detailed survey information, hedgerows are assumed to be native species-rich, although it is likely that a proportion of the hedgerow network will be species-poor. Hedgerows are listed on the Scottish Biodiversity List and function as wildlife corridors. The hedgerow network as a whole is of up to county value.

Watercourses

6.6.27 Ewes Burn and its tributary are located within land required for the construction of the Proposed Scheme. It feeds Stand Burn and Kirtle Water to the south. Kirtle Water is in the Gretna Coastal catchment of the Solway Tweed river basin.

6.6.28 For the purpose of this assessment and in the absence of survey data, the Ewes Burn is treated as a habitat of principal importance, covered under the Lowland Burns and Ditches category of the Dumfries and Galloway BAP. It is assumed to be of up to local value.

Protected and/or notable species

6.6.29 A summary of the likely value of protected and/or notable species of relevance to the assessment is provided in Table 23.

Table 23: Protected and/or notable species within the Annandale area

Resource/ feature	Value	Receptor	Baseline and rationale for valuation
Bats	Up to county	Bat assemblage associated with habitats in the Annandale area; woodland, hedgerow and the Ewes Burn	Hedgerows, woodland and the Ewes Burn provide linear features suitable for foraging and commuting and are well connected to the wider landscape. Larger agricultural fields are assumed to provide limited opportunities for foraging, but roosts may be present in mature trees within the ancient woodland south of Grahamshill Railway Cottages and hedgerows. Common and widespread species present in the local area are assumed to utilise land required for the construction of the Proposed Scheme. Desk study data indicates that pipistrelle species, *Myotis* species (Brandt's bat or whiskered bat) and brown long-eared bat are all present within 5km of the land required for the construction of the Proposed Scheme. Species rarer in Scotland, including *Nyctalus* species, may also be present.
Birds	Up to county	Breeding bird assemblage associated with habitats in the Annandale area	The breeding bird assemblage is assumed to largely consist of widespread species, but may include conservation priorities such as skylark and waders (for example redshank and lapwing). Land required for the construction of the Proposed Scheme is suitable for supporting species that use arable and grassland habitats and these species are present in the local area[147]. Hedgerow and scrub habitats present also provide suitable conditions for other farmland birds including scarcer priority species such as tree sparrow, shown to be present in the local area by desk study data.
	Up to county	Barn owl associated with habitats in the Annandale area	Grassland, woodland and hedgerow margins provide suitable foraging habitat for barn owl and mature trees and structures within, or adjacent to the land required for the construction of the Proposed Scheme are assumed to provide suitable roost locations. Desk study data confirms the presence of barn owls in the local area. The area of habitat required for the Proposed Scheme is assumed suitable for one or two breeding pairs if present.
	Up to local/parish	Wintering bird assemblage associated with habitats in the Annandale area	From aerial photography, limited observations from publicly accessible adjacent land and data available through the Habitat Map of Scotland, habitats within the land required for the construction of the Proposed Scheme include parcels of improved grassland interspersed by rough, cattle and sheep-grazed pasture between the WCML and the B7076. No wildfowl or wader species were recorded during observational visits completed during winter 2020-21. Instead, the bird assemblage was characterised by locally common and widespread species typical of farmland habitats in lowland Scotland. The document to inform the HRA contains a detailed assessment of the importance of these habitats for wintering birds (see Volume 5: Appendix

[147] Scottish Ornithologists' Club (2018), *Birds in Dumfries and Galloway 2017, Dumfries and Galloway Bird Report No. 28. Ed.* Henderson, B.D. and back issues.

Resource/ feature	Value	Receptor	Baseline and rationale for valuation
			EC-004-OR003). Whilst accessible data indicates that geese do not use the land[148], in the absence of standard field surveys, on a precautionary basis, the possibility that small numbers of wildfowl and wader species utilise the habitat present cannot be discounted.
Fish	Up to county	Fish assemblages within the Ewes Burn	The Ewes Burn flows into Kirtle Water, and within this catchment a fish assemblage including river lamprey and brook lamprey[149] is present. In the absence of habitat survey data, whilst a fish assemblage is assumed to be present in the Ewes Burn including lamprey species, species diversity is likely to be low given the small size of the watercourse. River lamprey is an Annex III species. River and brook lamprey are species of principal importance[150] and their populations are declining across the UK.
Otter	Up to local/parish	Population of otter using the Ewes Burn	Desk study data indicates the presence of otter within the same river catchment at Kirtle Water and the River Sark. Suitable habitat along the Ewes Burn connected to other drainage channels within the larger Kirtle Water catchment is assumed to be occupied by otter.
Aquatic macroinvertebrates	Up to local/parish	Potential aquatic macroinvertebrate assemblage within the Ewes Burn	The current overall WFD condition status of the Ewes Burn is 'Poor'[151], but the biological elements score for macroinvertebrates is recorded as 'Good'.
Amphibians	Up to local/parish	Populations of amphibian species including palmate newt, smooth newt, common toad and common frog	These common amphibian species are assumed to be present in association with terrestrial habitat within and adjacent to land required for the construction of the Proposed Scheme (see BID EC-002-OR003). While there are no mapped water bodies within the land required for the construction of the Proposed Scheme, water bodies are present within 280m to the south, separated by the A74(M). Woodland, hedgerow and grassland habitats are assumed to be utilised by these species during their terrestrial phase for foraging, dispersal and shelter. Each of these species is common and widespread throughout the UK, and relatively widespread in Scotland.

[148] Mitchell. C. (2012), *Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland.* Wildfowl & Wetlands Trust/Scottish Natural Heritage Report, Slimbridge. 108pp. Available online at: https://monitoring.wwt.org.uk/wp-content/uploads/2013/07/FeedingDistribution_PGGJScot_2012.pdf.

[149] Hume, J.B. (2017), *A review of the geographic distribution, status and conservation of Scotland's lampreys.* The Glasgow Naturalist (online 2017) Volume 26, Part 4. Available online at: https://www.glasgownaturalhistory.org.uk/gn26_4/Hume_lampreys_Scotland.pdf.

[150] Natural Environment and Rural Communities Act (2006). Available online at: http://www.legislation.gov.uk/ukpga/2006/16/section/41.

[151] Scottish Environment Protection Agency (2017) Water classification hub. Available online at: https://www.sepa.org.uk/data-visualisation/water-classification-hub/.

Resource/ feature	Value	Receptor	Baseline and rationale for valuation
			No records indicating the presence of great crested newts were returned within 500m of the Proposed Scheme. This is consistent with modelling undertaken on behalf of NatureScot (formerly Scottish Natural Heritage (SNH)), that indicates a limited objective range for great crested newts in the vicinity of the Proposed Scheme[152].
Badger	Up to local/parish	Badger population associated with habitats in the Annandale area; woodland, hedgerow and grassland	Suitable habitat for badger is present within and adjacent to land required for the construction of the Proposed Scheme and badgers are assumed to be present. This species is relatively widespread and common.
Reptiles	Up to local/parish	Potential small populations of reptiles in the Annandale area	Desk study data indicates the presence of reptile species including common lizard, slow worm, grass snake and adder within the local area, beyond the land required for the construction of the Proposed Scheme. It is assumed that low populations of common lizard and slow worm are present in association with field margins, hedgerows and grassland within the land required for the construction of the Proposed Scheme.

[152] Wilkinson, J.W., Arnell, A., Driver, D. & Driver, B. (2014), *Elaborating the distribution of the great crested newt in Scotland (2010-2011)*. Scottish Natural Heritage Commissioned Report No. 793. Available online at: https://www.nls.uk/e-monographs/2014/793.pdf.

Future baseline

Construction (2025)

6.6.30 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2025.

6.6.31 No committed developments of relevance for ecology and biodiversity have been identified in this area that will materially alter the baseline conditions in 2025.

Operation (2038)

6.6.32 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2038.

6.6.33 No committed developments of relevance for ecology and biodiversity have been identified in this area that will materially alter the baseline conditions in 2038.

Effects arising during construction

Avoidance and mitigation measures

6.6.34 The following measures have been included as part of the design of the Proposed Scheme (additional to the landscape planting as shown on the Map Series CT-06 for the Proposed Scheme, which will be largely a mixture of woodland/scrub and grassland), and contribute towards limiting effects on habitats and species:

- refinement of the working area adjacent to Gretna Flow required to access and re-route underground the existing overhead power lines. Gretna Flow is almost entirely excluded from the land required for the construction of the Proposed Scheme, the small area included in the land required for the construction of the Proposed Scheme provides a working area for oversailing purposes only which reduces the extent of habitat loss; and
- realignments of the Ewes Burn throughout the Proposed Scheme to include a largely open channel (with two culverts beneath access tracks) to reduce loss of aquatic habitat and allow free passage for wildlife.

6.6.35 The assessment assumes implementation of the measures set out within the draft Code of Construction Practice[153] (CoCP), which includes sensitive construction practices and habitat management plans.

6.6.36 Section 9 of the draft CoCP requires contractors to implement a range of measures to protect ecological receptors including the following:

[153] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

- manage impacts from construction, including the timing of works, on designated sites, protected and notable species and other features of ecological importance such as ancient woodlands and watercourses;
- reduce habitat loss by keeping the working area to the reasonable minimum;
- reinstatement of areas of temporary habitat loss;
- restoration and replacement planting;
- management measures for potential ecological impacts to control dust, water quality and flow, noise and vibration, and lighting;
- provision of a watching brief, where relevant;
- relocation or translocation of species, soil and/or plant material, as appropriate;
- consultation with NatureScot, SEPA, local wildlife trusts and relevant planning authorities prior to and during construction; and
- compliance with all wildlife licensing requirements, including those for protected and invasive species and designated sites.

Assessment of impacts and effects

6.6.37 Effects arising during construction that are significant at the local/parish level or above are described below. Effects significant below local/parish level relevant to the Annandale area are listed in the ecological register of significant effects below local level, in Volume 5: Appendix EC-003-OR003.

Designated sites

6.6.38 Raeburn Flow SAC will not be affected by construction of the Proposed Scheme. There is no hydrological connection between the SAC and land required for the construction of the Proposed Scheme. At its closest, the land required for the Proposed Scheme is 1.1km to the south of the SAC, comprising the access route to Williamsfield Farm on land 30m lower than the SAC. The underground diversion of the existing overhead power lines near Cranberry Farm will lie beyond this to the south-west. The habitats present within the SAC lie up the hydraulic gradient from the land required for the construction of the Proposed Scheme and will not be directly affected by changes in surface water flow, which will naturally flow south/south-west away from the SAC, nor will there be localised changes to groundwater flow resulting from the construction of the Proposed Scheme.

6.6.39 An appraisal of the potential effects of the construction of the Proposed Scheme on the integrity of the Solway Firth SPA, Upper Solway Flats and Marshes Ramsar site and Solway Firth SAC is provided in Volume 5: Appendix EC-004-OR003. These documents inform an HRA Screening Report and Appropriate Assessment and consider likely significant effects on qualifying species resulting from construction and operation of the Proposed Scheme. No standard field surveys have been carried out to date; consequently, the approach adopts a precautionary approach.

6.6.40 In view of the distance between the land required for the construction of the Proposed Scheme and the estuary, no direct or indirect likely significant effects upon the Solway Firth SAC are anticipated.

6.6.41 The appraisal assesses the likely significance of changes to potentially functionally linked habitat, to the Upper Solway Flats and Marshes Ramsar site and Solway Firth SPA, resulting from the Proposed Scheme. Impacts upon the majority of species for which the SPA and Ramsar site are classified/listed are highly unlikely because they are not present or, they are potentially present in very low numbers within and adjacent to the land required for the construction of the Proposed Scheme. Based on the best available information (including desk study data and the observations of birds from adjacent, publicly accessible land), with respect to species that may be present, it is considered that the land required for construction of the Proposed Scheme is not critical to the maintenance of the integrity of the SPA or Ramsar site. For that reason, it is concluded that the construction and operation of the Proposed Scheme would result in no adverse effects upon these sites. The conclusions have been shared with NatureScot, who has not raised any concerns.

6.6.42 Construction of the Proposed Scheme will result in the permanent loss of 0.2ha of remnant, long-established (or plantation origin) woodland identified on the ancient woodland inventory, comprising the woodland south of Grahamshill Railway Cottages. The loss of ancient woodland will result in a permanent adverse effect on this habitat that is significant at national level.

6.6.43 Construction of the Proposed Scheme has potential to affect groundwater flow towards the following ancient woodlands Blacksike Wood ancient woodland, Mossknowe Lodge Wood ancient woodland, Grahamshill Railway Cottages and Billy's Wood. These woodlands are located on predominately mineral gley soils and there are no mapped springs within them. It is unlikely that these woodlands are groundwater dependent, supporting species that are critically dependent on groundwater.

Habitats

Hedgerows

6.6.44 On a precautionary basis, it is assumed that all hedgerows (10.1km) within the land required for the construction of the Proposed Scheme will be permanently lost and the remaining hedgerow network will be fragmented. This total, however, includes some hedges that are likely to be retained, such as those located within land required for overhead line utility diversions/realignments and those located within land required for habitat creation. The combined loss and severance of hedgerows within the land required for the construction of the Proposed Scheme will have a permanent adverse effect that is significant at up to county level.

Watercourses

6.6.45 Two watercourse realignments are proposed on Ewes Burn around the southern edge of the southern reception tracks and depot sidings.

6.6.46 In addition, a further unnamed watercourse (a Tributary of the Ewes Burn 1) will be diverted for approximately 400m around the southern edge of the depot sidings.

6.6.47 Riparian vegetation associated with the Ewes Burn and its tributaries, which forms part of the priority habitat, will be lost during construction. This habitat loss will have a permanent adverse effect significant at local/parish level.

Species

Bats

6.6.48 The removal or disturbance of habitat features that are utilised by bats during breeding, hibernation or migrating between roosts is considered to have the potential to result in adverse effects on the bat populations or assemblages during construction. However, the point at which such impacts are considered likely to result in significant adverse effects on the conservation status of a population will differ depending on the status of the species concerned.

6.6.49 The impact of disturbance on bat populations will generally be localised and limited to the period of construction. Bats utilising retained habitats may be subject to irregular and localised disturbance from lighting and noise during the construction period where works in autumn, winter and spring may be carried out for short periods after dusk or prior to dawn. These impacts will only temporarily deter bats from using foraging and commuting habitats and the implementation measures that are described in the draft CoCP will reduce potential disturbance effects to a level that is not significant.

6.6.50 The land required for the construction of the Proposed Scheme spans the existing WCML and lies to the north of the A74(M). This existing road and rail infrastructure limits habitat connectivity.

6.6.51 The removal of trees within woodland and hedgerows within the land required for the construction of the Proposed Scheme may result in the loss of bat roosts, if they are present. In addition, the construction of the Proposed Scheme may result in disturbance to any nearby roosts. It is possible that this will include maternity roosts, which are important to the continued breeding success of bat populations. It is assumed on a precautionary basis that trees in the woodland and hedgerow within the land required for construction of the Proposed Scheme include roosts of both common and widespread species, and rarer species such as *Nyctalus* and that construction will result in a permanent adverse effect on bat assemblages, significant at up to county level.

6.6.52 Loss of other suitable habitats within the land required for the construction of the Proposed Scheme may require some bats to travel further and expend more energy during day to day foraging and movement throughout their home range for the duration of construction. However, such effects alone are for all species considered unlikely to result in sufficient disturbance of the populations or assemblages concerned to result in an adverse effect on their conservation status.

Barn owl

6.6.53 The construction of the Proposed Scheme will result in the loss of potential barn owl foraging habitat in the form of large areas of arable land, grassland and field margins and the loss of potential roosting and nesting sites within mature trees. This loss represents a permanent adverse effect on the potential barn owl populations, which will be significant at up to county level.

Breeding birds

6.6.54 The construction of the Proposed Scheme will result in the loss of grassland, hedgerow and woodland habitats available to breeding birds. Open farmland habitat including larger areas of grassland will be lost. On a precautionary basis, it is assumed that species such as tree sparrow, lapwing and skylark will be affected. The effect would be significant at up to county level.

Wintering birds

6.6.55 A detailed appraisal of the likely use of the land required for the construction of the Proposed Scheme by wintering waders and wildfowl is contained within Volume 5: Appendix EC-004-OR003. The appraisal concluded that the land required for the construction of Proposed Scheme is unsuitable for the majority of bird species for which the Solway Firth SPA and Ramsar site is designated, however low numbers of the following species could be present over the winter period: whooper swan, golden plover, barnacle goose and pink-footed goose. Nevertheless, given the characteristics of the habitat, including disrupted lines of sight and lack of standing water, the land required for the construction of the Proposed Scheme is not likely to support these species (in the unlikely event that they are present at all) in numbers and frequency likely to affect the integrity of the SPA/Ramsar site. For this reason, it is concluded that there will be no adverse effect on the integrity of the SPA or Ramsar site through habitat loss, deterioration or disturbance.

Fish

6.6.56 The Ewes Burn and associated tributaries will be realigned during the construction of the Proposed Scheme. The loss of aquatic habitat where the channel is culverted will reduce habitat available to the fish assemblage present, which may include priority species such as river and brook lamprey, this will have a permanent adverse effect significant at local/parish level.

Other mitigation measures

6.6.57 This section describes other mitigation measures designed to reduce or compensate for significant ecological effects. These include habitat creation and habitat enhancement.

Habitats

Woodland

6.6.58 The Proposed Scheme will result in the loss of 0.2ha of ancient woodland, from the woodland south of Grahamshill Railway Cottages, which is irreplaceable, and which is significant at national level. To partially compensate for this loss and ensure that the populations of protected and notable species including bats are maintained, 2.1ha native broadleaved woodland planting is included to the south of Grahamshill Railway Cottages and the WCML.

6.6.59 Woodland planting to partly compensate for the loss of ancient woodland will include further measures such as translocation of ancient woodland soil with its associated seed bank where appropriate. Other measures such as planting native trees and shrubs of local provenance and translocation of dead wood will be undertaken in accordance with the Ecological Principles of Mitigation within the SMR.

6.6.60 The target habitat type for woodland planting is mixed deciduous woodland habitat of principal importance. Landscape mitigation planting will provide some additional benefits to wildlife and will help to connect areas of higher quality habitats.

Hedgerows

6.6.61 New hedgerows will be planted as replacement for those lost as a result of the construction of the Proposed Scheme. A total of 4.6km of new hedgerows will be planted and the species composition will be characteristic of the surrounding area. This represents a net reduction in hedgerow of 5.5km after mitigation, which represents a residual adverse effect that is significant at up to county level.

Watercourses

6.6.62 Where the Ewes Burn watercourse is realigned, the channel will be naturalised, where reasonably practicable, with a profile to promote the establishment of marginal vegetation and pools. This will ensure an increased length of open water course. Once the vegetation has developed, the adverse effect on the Ewes Burn watercourse will be reduced to a level that is not significant.

Species

Bats

6.6.63 To replace roosts that will be lost to construction, artificial roosts will be provided across the Proposed Scheme in accordance with the Ecological Principles of Mitigation within the SMR. The habitat creation measures detailed above in response to habitat loss, including creation of grasslands, hedgerows and semi-natural woodlands will compensate for those bat foraging habitats lost within the land required for the construction of the Proposed Scheme as detailed below.

6.6.64 The partial loss of woodland foraging and commuting habitat within the land required for the construction of the Proposed Scheme will be addressed through provision of suitable replacement foraging habitat to the south of the WCML. This habitat is to be established at locations between Grahamshill Railway Cottages and Cranberry Cottage, and around Cranberry Cottage, along the continuous landscape embankment to the south of the Annandale depot, within the land required for the construction of the Proposed Scheme. Once these measures are implemented, the effects on the bat assemblage associated with woodland habitats within the land required for the construction of the Proposed Scheme will be reduced to a level that is not significant.

6.6.65 The loss of tree roosts, if present, will be addressed through the provision of suitable replacement roosting opportunities. These will be established within areas of retained woodland near to roosts to be removed and in the vicinity of suitable foraging habitat. Following the implementation of these measures, the effects on the bat assemblage will be reduced to a level that is not significant.

Birds

6.6.66 The Proposed Scheme will include habitat creation measures to address the adverse effects on barn owl and farmland birds including tree sparrow. This habitat creation will include the provision of grassland and hedgerow habitats adjacent to the south of the Proposed Scheme. These habitats will provide foraging and nesting opportunities for barn owl populations in the area of the Proposed Scheme. Once the habitats have become established, the adverse effect on barn owl populations and farmland bird species resulting from the loss of foraging habitat and potential nesting sites will be reduced to a level that is not significant.

Badger

6.6.67 Although there will be no significant effects on badger populations in this area, mitigation measures to address the potential disturbance of badgers will be provided in accordance with the Ecological Principles of Mitigation within the SMR. This will include the provision of badger proof fencing and replacement setts where necessary.

Summary of likely residual significant effects

6.6.68 This section describes likely significant residual ecological effects during construction, taking account of the mitigation and compensation proposed.

6.6.69 Ancient woodland is irreplaceable and the loss of 0.2ha of this habitat will result in an adverse residual effect upon ancient woodland which is significant at the national level.

6.6.70 On a precautionary basis, it is assumed that there will be a reduction in hedgerow of 5.5km, which will result in a permanent adverse residual effect that is significant at up to county level. In addition to the mitigation described, opportunities will be sought for additional retention and replacement of hedgerow within the land required for the construction of the Proposed Scheme.

Cumulative effects

6.6.71 No cumulative effects on ecological receptors have been identified in the Annandale area.

Effects arising during operation

Avoidance and mitigation measures

6.6.72 Within the Proposed Scheme the following elements of the design will avoid or reduce impacts on features of ecological value during operation:

- Cranberry Farm accommodation overbridge will maintain farm access across the Proposed Scheme. This structure will be of a sufficient size to also allow for the passage of a range of wildlife species, and its primary purpose will not discourage use by most wildlife species. This overbridge will reduce barrier effects by facilitating wildlife movement across the Proposed Scheme; and
- where existing watercourses (the Ewes Burn) will be crossed by components of the Proposed Scheme, safe means of passage will be provided to allow the movement of mammals such as otter.

6.6.73 Operation of the Annandale depot will require the use of permanent directional lighting for up to 24 hours a day. Provision of artificial lighting may result in light spill onto adjacent habitats. However, insofar as reasonably practicable, lighting type, column height and location will be selected to reduce light spill and glare.

Assessment of impacts and effects

6.6.74 Significant effects arising during operation at local/parish level or above are described below. Significant effects on ecological features at below local/parish level are listed in Volume 5: Appendix EC-003-OR003.

Species

Bats

6.6.75 Operation of the Annandale depot has the potential to result in impacts on bat populations through noise, vibration and lighting emitted during operation. The point at which such impacts are considered to result in a significant adverse effect on the conservation status of the population concerned will differ between species. As a consequence, the following assessment of operational impacts takes into account the differing character and nature of the bat population within the assemblage concerned in determining the likely effects of the Proposed Scheme.

6.6.76 Due to the large areas over which bats forage it is likely that any loss of, or displacement from, suitable foraging habitat in the vicinity of the Proposed Scheme will in itself amount to only a small proportion of the wider available resource. However, the impact of any such

disturbance or displacement could be greatly increased if bats are hampered in moving between breeding sites, hibernation sites and other roosts which they commonly utilise.

6.6.77 Noise, vibration and lighting associated with operation of the Annandale depot have the potential to disturb bat species foraging and commuting within habitats close to the Proposed Scheme. Understanding of the impact of noise upon bats from intermittent sources is limited. Available research tends to focus on impacts associated with road noise[154,155]. Noise generated from maintenance activities will be intermittent and localised within the Annandale depot area. It is reasonable to conclude that this will likely have localised, temporary effects upon bat foraging activity, displacing bats from specific locations close to sources of noise.

6.6.78 Operation of the Annandale depot will require the use of artificial lighting for up to 24 hours a day. Provision of artificial lighting may result in light spill onto adjacent habitats which has the potential to affect the bat assemblage present in the immediate surroundings through a reduction in the availability of suitable foraging habitat and creating barriers to movement along commuting routes. However, where reasonably practicable, lighting type, column height and location will be selected to reduce light spill and glare. Accordingly, following incorporation of these measures into the lighting design, it is anticipated that the adverse effects on the bat assemblage associated with habitats in the Annandale area will be reduced to a level that is not significant.

6.6.79 It is possible that there may be localised disturbance to foraging and commuting habitat in proximity to the Annandale depot. However, due to the availability of alternative foraging and commuting habitat nearby, this is unlikely to result in a significant adverse effect on the conservation status of the bat assemblages present in the Annandale area.

Monitoring

6.6.80 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.6.81 There are no area-specific requirements for monitoring ecology and biodiversity effects or mitigation during the operation of the Proposed Scheme in the Annandale area.

[154] Schaub, A., Ostwald, J. and Simeers, B.M. (2008), Foraging bats avoid noise. Journal of Experimental Biology, 2008, 211 (19), 3174-3180. Available online at: https://doi.org/10.1242/jeb.022863.

[155] Finch, D., Schofield, H. and Mathews, F. (2020), Traffic noise playback reduces the activity and feeding behaviour of free-living bats, Environmental Pollution, Volume 263, Part B, 2020, 114405, ISSN 0269-7491. Available online at: https://doi.org/10.1016/j.envpol.2020.114405.

6.7 Historic environment

Introduction

6.7.1 This section of the report provides a description of baseline conditions for heritage assets and the identified impacts and likely significant effects resulting from the construction and operation of the Proposed Scheme within the Annandale area. Consideration is given to the extent and value of heritage assets including archaeological and palaeoenvironmental remains, historic buildings, the built environment and historic landscape.

6.7.2 Engagement has been undertaken with Historic Environment Scotland (HES) and Dumfries and Galloway Council (DGC). The purpose of this engagement has been to discuss the assessment approach, to obtain relevant baseline information and to inform the design development and assessment of the Proposed Scheme.

6.7.3 Appendices and Background Information and Data (BID) reports accompany this section of the report. These are:

- Volume 5: Appendix HE-002-OR003 – Summary gazetteer, impact assessment table, archaeological character areas and historic landscape character areas;
- Volume 5 Map Book HE-01 and HE-02 – Heritage assets within the study area and map book HE-03 – Archaeological sub-zones; and
- BID HE-001-OR003[156] – Historic environment baseline report (including a full gazetteer of heritage assets) and remote sensing report (aerial photograph and LiDAR[157] assessment), and Map Book HE-005.

6.7.4 Heritage assets have been given a Unique gazetteer identifier (UID), for example OR003_0001. These have been allocated to all heritage assets within the gazetteer and are referenced throughout the Environmental Statement (ES), BID reports and in map books.

6.7.5 Maps showing the location of the key environmental features (Map Series CT-10), and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 6.1.

Scope, assumptions and limitations

6.7.6 The general scope, assumptions and limitations for the historic environment assessment are set out in full in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and

[156] High Speed Two Ltd (2022), High Speed Rail (Crewe - Manchester), *Background Information and Data, Historic Environment, BID HE-001-OR003*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[157] LiDAR meaning 'light detection and ranging' is a surveying method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor, this can be used to identify evidence of archaeological earthwork.

Methodology Report (SMR)[158], including the method for determining the value of a heritage asset and magnitude of impact.

6.7.7 The assessment focuses on the extent to which the Proposed Scheme will affect designated and non-designated heritage assets. The Proposed Scheme could impact heritage assets through the alteration, demolition or removal of the asset, or as a result of changes within the asset's setting, where setting contributes to the heritage value of the asset.

6.7.8 The study area for the assessment of effects on designated and non-designated heritage assets is the land required for the construction of the Proposed Scheme plus 500m on each side in rural areas. This is referred to in the remainder of this section as the 500m study area.

6.7.9 Designated heritage assets within a study area of up to 2km from the land required for the construction and operation of the Proposed Scheme have been considered in relation to potential effects arising from changes within an asset's setting. This is referred to in the remainder of this section as the 2km study area.

6.7.10 The historic environment methodology includes the consideration of the relevant interactions with other topics, including ecology and biodiversity, landscape and visual, socio-economics, sound noise and vibration, water resources and flood risk, and in-combination climate change impacts. These interactions have been included in the assessment of baseline conditions, impacts and effects.

6.7.11 Where noise is considered, this is within the context of the way in which sound and noise currently contribute to the heritage value of the assets and is not a reference to absolute noise levels or sound, or the noise or vibration impacts on the health and quality of life of people who live in or visit the area.

6.7.12 For the purpose of this assessment, it is generally assumed that heritage assets within the land required for the construction of the Proposed Scheme will be removed. Exceptions to this are Caledonian Railway (West Coast Main Line, WCML) (OR003_0109), Blacksike Bridge and War Memorial (OR003_0122) and Williamsfield Railway Bridge (OR003_0124), which although within the land required for the construction of the Proposed Scheme will not be removed.

6.7.13 The spatial extent of the 2km study area (described above) partially extends into England. However, no designated heritage assets, or assets of equivalent heritage value, in England are located within the 2km study area.

6.7.14 Publicly accessible historic environment data have been used in determining baseline conditions in the Annandale area. The assessment has been undertaken using these sources of information and professional judgement.

[158] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

Environmental baseline

Existing baseline

6.7.15 A full list of data sources used in establishing baseline conditions is provided in BID HE-001-OR003. In addition to the desk-based assessment, a desk-top analysis of remote sensing data has been undertaken in the Annandale area.

Designated assets

6.7.16 Designated heritage assets within the 2km study area are described in Volume 5: Appendix HE-002-OR003. There are no designated heritage assets located partially or wholly within the land required for the construction of the Proposed Scheme.

6.7.17 The assets summarised below are located outside of the land required for the construction of the Proposed Scheme but are partially or wholly within the 2km study area. Only assets where a significant effect is predicted, as described in Section 9.4 and 9.5, are named below:

- ten scheduled monuments of high heritage value. These include four Bronze Age burial cairns; one tower house and five Iron Age settlements;
- two Category A listed buildings of high heritage value. These include one private house and one burial enclosure;
- twenty one Category B listed buildings of high heritage value. These include eight private houses and associated structures; four churches and associated structures; two rows of housing; two farmhouses and steadings including Grahamshill Farmhouse and Steading (OR003_0007); one smithy; one workhouse; one transport bridge and one hotel; and
- eight Category C listed buildings of moderate heritage value. These include three rows of housing; two farmhouses and steadings; one private house and one shop.

Non-designated assets

6.7.18 The non-designated heritage assets summarised below lie wholly or partially within the land required for the construction of the Proposed Scheme. Only assets where a significant effect is predicted, as described in Section 9.4 and 9.5, are named below.

6.7.19 One non-designated heritage asset of high heritage value lies partially within the land required for the construction of the Proposed Scheme, the Whinnyrig Field System (site of) (OR003_0083). One non-designated heritage asset of low heritage value lies wholly within the land required for the construction of the Proposed Scheme, Redhouse Milestone (OR003_0075). There are no non-designated heritage assets of moderate heritage value within the land required for the construction of the Proposed Scheme.

6.7.20 The non-designated heritage assets summarised below lie wholly or partially within the 500m study area.

6.7.21 There are 11 assets of moderate heritage value within the 500m study area. These include two prehistoric burial cairns, a Roman temporary camp, three sites of medieval tower houses, three medieval cross fragments, a 20th century war memorial and a 20th century municipal pumping station.

6.7.22 There are 65 assets of low heritage value within the 500m study area. These include several farms, cottages and properties which reflect the rural landscape of the area; four post-medieval lodges associated with country houses, a cave, archaeological remains of four linear features, archaeological remains of two field systems, four post-medieval industrial sites and a milestone.

Historic environment overview

6.7.23 The bedrock geology of the Annandale area mainly comprises sandstone and shale. The sandstone has been quarried locally and characterises many of the buildings within the area, including Kirkpatrick-Fleming Parish Church (OR003_0008). The bedrock is generally overlain by glacial till deposited at the end of the last Ice Age. The 2km study area is bisected by two shallow river valleys; Kirtle Water in the west and the River Sark to the east. Along the course of these rivers and tributaries, such as Ewes Burn, the glacial till is overlain by alluvial and river terrace deposits. Peat deposits are found within areas known as mosses and flows, located at Solway Moss and Nutberry Moss, with smaller ones at Gretna Flow and Ewes Burn.

6.7.24 Evidence of Palaeolithic occupation is scarce as much of the region is likely to have been under glacial ice. Environmental change at the end of the glacial period saw an environment of grassland being colonised by birch woodland within the 2km study area. These changes encouraged the emergence of Mesolithic people, and the subsequent development of the early agricultural societies of the Neolithic period.

6.7.25 Archaeological evidence from the Mesolithic and Neolithic periods is usually characterised by discoveries of stone or flint tools, as well as environmental evidence. Evidence within the 2km study area is scarce. However, at the The Bracken (OR003_0020), a small number of late Mesolithic stone tools were recovered. The site continued to be used, with possible wooden structures securely dated to the early Neolithic. The dating of another stakehole suggested Neolithic or early Bronze Age activity.

6.7.26 The Bronze Age is defined by the introduction of bronze metalwork, changes in pottery style and the increase of single burials. Knowledge of the period is generally gained from physical evidence of settlement and burials. There is evidence for continuity of settlement at The Bracken (OR003_0020) and several burial monuments have been recorded within the 2km study area. This includes ones at Calvertsholm Cottages (OR003_0017; OR003_0022).

6.7.27 The Iron Age, like the Bronze Age before, was a continuous evolution of the prehistoric period. Several enclosed settlements have been identified within the 2km study area, including The Bracken (OR003_0020) and a palisaded enclosure at Milligansbush (OR003_0038). Some of these are associated with field systems and droveways, including Whinnyrig (OR003_0021) and Calvertsholm (OR003_0025). Whinnyrig's field system is more

extensive than previously thought and remote sensing analysis found that it extends further north and west (OR003_0083, see BID HE-001-OR003 for details). Aerial survey at Calvertsholm has also revealed evidence for roundhouses within its boundary. Environmental evidence indicates the settlement at The Bracken was possibly a farming settlement located on the edge of woodland. It is likely that many of the settlements contained roundhouses for individual family groups. These would have been surrounded by field systems for farming and droveways to allow the grazing of livestock on surrounding land.

6.7.28 Britain came under Roman control after AD 43, but the Romans did not reach southern Scotland until around AD 80. After a staged withdrawal, construction started on Hadrian's Wall approximately 10km to the south of the Proposed Scheme in AD 122. In AD 139, the Romans established the Antonine Wall between the Firth of Forth and Firth of Clyde. However, expansion was short-lived, and Roman occupation within Scotland only lasted around 100 years. Large marching camps and enclosures were built to the north of Hadrian's Wall to protect the army such as at Kirkpatrick-Fleming (OR003_0062). This lay along the Roman road which connected the forts at Carlisle and Birrens (OR003_0078, known as Margary 7f). This now forms a section of the B7076 and lies within the Proposed Scheme. It is common for settlements, cemeteries and other activity to be found along and close to the routes of Roman roads, however none have been identified within the 2km study area. Based on evidence from elsewhere, it is likely that indigenous settlement at sites such as Whinnyrig (OR003_0021) continued to be occupied throughout the Roman period.

6.7.29 In the early medieval period after the collapse of Roman rule in Britain, new kingdoms emerged. After the establishment of the Rheged Kingdom in the 6th century, the 2km study area fell within the Kingdom of Northumbria until the 9th century. In the early 10th century, the 2km study area was part of the Kingdom of Strathclyde. Archaeological evidence is scarce for this period, however the settlement at The Bracken (OR003_0020) produced radiocarbon dates from this period, from two patches of charcoal overlying earlier ditches. This indicates that people were occupying the landscape at this time.

6.7.30 The 2km study area became part of the Kingdom of Scotland in the 11th century, however control of the Scottish border region by the Crown was not absolute and the area was subject to lawlessness. It led local landowners to build defensive tower houses including Redhall Castle Tower House (site of) (OR003_0071). These tower houses were located close to Kirtle Water and characterised the landscape alongside small farming hamlets, known as fermtouns. There is no archaeological evidence for fermtouns, however, farmsteads such as Grahamshill Farmhouse and Steading (OR003_0007) are likely to have originated in this period. Arable farming during this period is evidenced through the survival of levelled rig and furrow (ridge and furrow) and the mosslands may have been exploited although evidence is limited.

6.7.31 Agricultural improvement in the post-medieval period transformed the area. Mosslands, such as Gretna Flow, were drained and exploited for peat-cutting. There was a wholesale reorganisation of land ownership and field patterns, with farmland enclosed and improved. New farmsteads were constructed and others were improved and rebuilt. Sandstone

characterises the local building material and was used at farmhouses and steadings (associated farm buildings). These include Grahamshill Farmhouse and Steading (OR003_0007) and Williamsfield Farmhouse (OR003_0001), which were built from the 18th century onwards. The Graham family commissioned the rebuilding of Mossknowe House (OR003_0003) in 1767, and Cove House (OR003_0002) was also rebuilt in the 18th and 19th centuries. New villages were built, such as at Springfield in 1791, to take advantage of border trade.

6.7.32 Increased wealth from agriculture led to various improvements across the landscape, including improved transport links, new country houses and new villages. Transport links were improved within the 2km study area as the area was connected to urban markets. The Caledonian Railway (WCML) (OR003_0109) was built through the 2km study area in the 1840s, with Kirkpatrick Station (former) (OR003_0094) linking Scottish cities to Carlisle and the English rail network. The former Roman road from Carlisle (OR003_0078), now the B7076, was upgraded to a toll road in the 18th century. The road became a key route for those crossing the border and Kirkpatrick-Fleming developed along the road during this period. The Redhouse Milestone (OR003_0075) is an example of the historic waymarkers added along the road.

6.7.33 In the modern period, existing settlements were subject to piecemeal expansions however Gretna town was planned as a complete entity. It was constructed in the space of two years during the First World War to house around 20,000 workers from H. M. Factory Gretna, which manufactured cordite munitions. Further transport improvements were carried out in the later 20th century, with the Gretna Bypass completed in the 1970s. This road was upgraded again to a motorway in the 1990s, becoming the A74(M).

Future baseline

Construction (2025)

6.7.34 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2025.

6.7.35 No committed developments have been identified in this study area that will materially alter the baseline conditions in 2025 for historic environment.

Operation (2038)

6.7.36 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2038.

6.7.37 No committed developments have been identified in this study area that will materially alter the baseline conditions in 2038 for historic environment.

Effects arising during construction

Avoidance and mitigation measures

6.7.38 The design of the Proposed Scheme has sought to avoid adverse effects on heritage assets within the land required for construction insofar as reasonably practicable.

6.7.39 Section 8 of the draft Code of Construction Practice[159] sets out the measures that will be adopted, insofar as reasonably practicable, to control effects on heritage assets. These include:

- management measures that will be implemented for heritage assets that are to be retained within the land required for the Proposed Scheme;
- route-wide principles, standards and techniques for works affecting heritage assets; and
- a programme of historic environment investigation and recording (including archaeology and historic buildings) to be undertaken prior to or during construction works affecting the heritage assets.

Assessment of impacts and effects

6.7.40 Impacts on all heritage assets described above have been assessed and are set out in the Impact Assessment Table (Volume 5: Appendix HE-002-OR003). Only impacts on heritage assets resulting in significant effects are described in the assessment set out below. Effects on Historic Landscape Character Areas are set out in Volume 5: Appendix HE-002-OR003, and again only the significant effects are described below.

Temporary effects

6.7.41 The temporary construction works, such as excavations and earthworks for construction compounds, storage areas, and diversions of existing roads and services, have the potential to affect heritage assets during the construction period. Heritage assets could be affected as a result of changes within the assets' settings, where setting contributes to the value of the asset.

6.7.42 The following significant effects are expected to occur as a result of temporary impacts on designated or non-designated heritage assets due to changes that affect the contribution made by setting to the asset's heritage value.

6.7.43 Grahamshill Farmhouse and Steading (OR003_0007), now known as Mill Forge hotel and wedding venue, is a Category B listed building of high heritage value. The asset is located between two areas of land required for the construction of the Proposed Scheme and associated utility diversions. A cutting will be constructed within the field immediately to the north of the asset. The cutting will be bounded by landscaping earthworks and a new hedgerow within 95m of the asset. The asset is also located 10m north of land required for

[159] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

utility diversions within the existing alignment of the B7076. The asset comprises a 19th century farmhouse with an adjoining range and free-standing barn. The buildings are associated with the historic use of the asset as a farmhouse and steading. It is now a hotel and wedding venue. The asset's setting includes gardens to the west, a cluster of late 20th century buildings and car parking to the north and east. These are all associated with the function of the asset as a hotel and wedding venue. These modern additions affect the ability to appreciate the asset's historic function as a farm and make a negative contribution to the heritage value. Located approximately 70m to the south is the A74(M), which passes on a viaduct over the adjacent B7076. Although the motorway is screened by mature tree planting, it is audible from the asset and makes a negative contribution to the asset's heritage value. The asset is surrounded to the north, east and west by two large agricultural fields that contribute positively to its heritage value. The agricultural character of the fields inform an understanding of the asset's historic function as an estate farm. The temporary presence of construction machinery within agricultural land to the north of the asset during construction of the cutting will reduce the ability to understand and appreciate the historic interest of the buildings as a former estate farmhouse and steading. This will constitute a low impact and result in a moderate adverse significant effect.

Permanent effects

6.7.44 Permanent construction phase effects can occur either as a result of physical impacts on heritage assets within the land required for the Proposed Scheme, or through changes to the setting of heritage assets that affect the contribution made by setting to the asset's value.

6.7.45 The following significant effect will occur as a result of permanent physical impacts on heritage assets within the land required for the construction of the Proposed Scheme.

6.7.46 Whinnyrig Field System (OR003_0083) is a non-designated asset of high heritage value. The asset is partially located within the land required for the construction of the Proposed Scheme. The asset comprises a prehistoric rectilinear field system defined by single ditches seen as cropmarks. The cropmarks of the field system can be seen to the south of the WCML. The asset has group value with the scheduled monument of Whinnyrig, enclosed settlement, droveway and field system ENE of (OR003_0021). The heritage value of the asset (OR003_0083) lies primarily in its archaeological interest as part of the wider prehistoric settlement at Whinnyrig. The construction of the Proposed Scheme will result in the permanent removal of part of the asset through the construction of two southern reception tracks, landscaping earthworks, a pumping station and access road within the northernmost portion of the Whinnyrig Field System. In addition, two stretches of hedgerow planting, along the alignment of existing hedgerows will be improved but are not anticipated to result in substantial physical impacts to buried archaeological remains. Overall, this will constitute a medium impact and a major adverse significant effect.

6.7.47 Redhouse Milestone (OR003_0075) is a non-designated asset of low heritage value, located within the land required for the construction of the Proposed Scheme. The asset derives its heritage value from its historical and architectural interest as an example of a roadside

milepost. It will be removed during construction of the Proposed Scheme. This will constitute a high impact and result in a moderate adverse significant effect.

6.7.48 The following significant effects will occur as a result of permanent impacts on designated or non-designated heritage assets due to changes to their settings.

6.7.49 Grahamshill Farmhouse and Steading (OR003_0007) is a Category B listed building of high heritage value (also described above). A cutting will be constructed within the field immediately to the north of the asset. The cutting will be bounded by landscaping earthworks and a new hedgerow within 95m of the asset. The asset is surrounded to the north, east and west by two large agricultural fields that contribute positively to its heritage value. The agricultural character of the fields inform an understanding of the asset's historic function as an estate farm. The addition of railway infrastructure to the setting will change the character of the flat agricultural landscape. The construction of the cutting, approximately 130m north of the steading, will remove part of one of the fields that form the farmhouse and steading's agricultural setting. The landscaping earthworks and hedgerow will screen the asset from the new infrastructure. This will maintain some legibility of the rural setting, as parts of the fields around Grahamshill will remain. However, this will adversely impact the heritage value of the asset as it will affect the ease with which the agricultural history of the former estate farmhouse and steading can be understood. This will constitute a low adverse impact and result in a moderate adverse significant effect.

Other mitigation measures

6.7.50 Potential opportunities for further mitigation measures will continue to be considered through detailed design to reduce further the significant effects described above where practicable. These may include the identification of:

- suitable locations for advance planting, to reduce the effects of changes within the assets' setting where setting contributes to the heritage value of the asset;
- locations where the physical impacts on heritage assets can be reduced through the detailed design of the works; and
- the Redhouse Milestone (OR003_0075) will be removed during construction but will be safely stored for the duration of construction activities and will be returned, insofar as reasonably practicable, to its original location, or an alternative location agreed with the relevant stakeholder, before the Proposed Scheme is in operation.

Summary of likely residual significant effects

6.7.51 The temporary effects of construction activity on the setting of heritage assets have been considered. However, as these effects result from temporary construction activities they are restricted to the duration of those activities and are reversible.

6.7.52 Mitigation measures have been incorporated as set out above and taken into account during assessment. Therefore, the residual effects are the same as those reported under permanent construction phase effects.

6.7.53 A moderate adverse effect is predicted in relation to the removal of the Redhouse Milestone (OR003_0075). However, replacing the milestone as set out above will reduce the effect to a level that is not significant.

Cumulative effects

6.7.54 No cumulative effects on heritage assets during construction have been identified in the Annandale area.

Effects arising from operation

Avoidance and mitigation measures

6.7.55 Some of the design measures, as shown on the Map Series CT-06 within the Volume 4, Off-route effects Map Book, could reduce the operational impacts and effects on heritage assets. Landscape planting of hedgerows could increasingly reduce the effect of changes within the assets' setting within the study area as it matures around Grahamshill Farmhouse and Steading (OR003_0007).

Assessment of impacts and effects

6.7.56 The assessment considers the Proposed Scheme once operational; all effects are permanent.

6.7.57 During the operation of the Proposed Scheme no further ground works are anticipated. As such, there would be no further physical impacts on heritage assets arising from the operation of the Proposed Scheme.

6.7.58 Impacts on heritage assets arising from changes in their settings due to the presence of the Proposed Scheme are reported as permanent construction effects. These effects are not repeated but will continue throughout the operation of the Proposed Scheme.

6.7.59 It is predicted that there will be no additional significant effects on these assets during operation.

Other mitigation measures

6.7.60 The Proposed Scheme includes a number of design measures to address potential impacts and significant effects. No additional operational mitigation measures beyond those included within the Proposed Scheme design have been identified. Potential opportunities for further mitigation such as additional planting and noise fencing will be considered as part of the detailed design process.

Summary of likely residual significant effects

6.7.61 No mitigation beyond that described above has been identified. As a result it is currently anticipated that residual effects will be the same as those reported in the assessment of effects during operation.

Cumulative effects

6.7.62 No cumulative effects on heritage assets during operation have been identified in the Annandale area.

Monitoring

6.7.63 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.7.64 No area-specific heritage monitoring requirements during operation of the Proposed Scheme have been identified.

6.8 Land quality

Introduction

6.8.1 This section of the report presents the baseline conditions within the Annandale depot area in relation to land quality and reports the likely impacts and significant effects resulting from construction and operation of the Proposed Scheme. Consideration is given to land that potentially contains contamination and land that has special geological significance, either from a scientific, historical, mining and mineral exploitation or mineral resources point of view including geological Sites of Special Scientific Interest (SSSI) and Local Geological Sites (LGS), and areas of designated mineral resources. Consideration is also given to petroleum (including gas) prospects and licensing.

6.8.2 Engagement has been undertaken with the Coal Authority, Dumfries and Galloway Council (DGC), the Scottish Environment Protection Agency (SEPA), and the Animal and Plant Health Agency (APHA). The purpose of this engagement has been to discuss the Proposed Scheme and potential effects and obtain relevant baseline information. Engagement will continue as part of the development of the Proposed Scheme.

6.8.3 Maps showing the location of the key environmental features (Map Series CT-10), key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book.

6.8.4 Details of baseline information, conceptual site models (CSM) and risk assessments are outlined in Volume 5: Appendix LQ-001-OR003. Baseline data relevant to land quality are presented on maps LQ-01-803 to LQ-01-804 (in the Volume 4, Off-route effects Map Book).

6.8.5 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding water resources are addressed in the water resources and flood risk assessment. Issues regarding the disposal of waste materials, including contaminated soils, are addressed in Volume 3, Route-wide effects, Section 15.

6.8.6 The Proposed Scheme is described in Section 6.1.

6.8.7 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

6.8.8 The scope, assumptions and limitations for the land quality assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report (SMR)[160].

6.8.9 In accordance with the SMR, a risk-based approach was undertaken to identify contamination that may have an impact upon the construction of the Proposed Scheme. To support this, a desk-based assessment has been undertaken for the study area, defined as the land required for the construction of the Proposed Scheme plus a 250m buffer. In the case of groundwater abstractions, this buffer is increased to 1km.

6.8.10 For major above ground utilities, a pre-screening exercise has been completed to determine where these may break ground, or otherwise interact with land quality. In such cases, these are considered in the land quality assessment.

6.8.11 The majority of new and diverted minor utilities will be laid in the boundaries of existing highways within normal road construction layers and soils below. These have been considered in the context of the CSM approach. The lack of contact with nearby potentially contaminated sites, the usual approach to ensuring services are protected from contamination by design and choice of materials and the absence of sensitive receptors within the roadways, reduces the risk of an impact occurring. The potential impacts of laying these new and diverted utilities has, therefore, been scoped out of the assessment as they are unlikely to cause any significant land quality effects.

6.8.12 Potentially contaminated areas of land have been identified that could affect, or be affected by, the construction of the Proposed Scheme (e.g. contaminated soils may need to be removed or construction may alter existing contamination pathways). Each of these areas has been studied to evaluate the scale of potential impacts caused by existing contamination, if present, and what needs to be done to avoid significant consequences to people and the wider environment.

6.8.13 A CSM approach has been used to provide an understanding of the sources and types of contaminants that may be present, the likely sources and/or pathways by which contamination can spread and the potential receptors (i.e. people and the wider

[160] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

environment) that could be affected. It indicates the types of impacts that existing contamination may be having at present and may have during and after construction.

6.8.14 The minerals assessment is based upon the mineral resources[161] identified on published mineral plans[162], and existing planning or licensed areas. Any inference of minerals provided by geological maps/reports is excluded (except where these are covered by a published mineral plan).

6.8.15 The geoconservation assessment is based upon local authority and publicly available local geological trust records.

Environmental baseline

Existing baseline

6.8.16 Baseline data have been collected from a range of sources including Ordnance Survey (OS) mapping, the British Geological Survey (BGS), Coal Authority, DGC, APHA records, SEPA, as well as online sources such as the local geological trust[163]. Further details are given in Volume 5: Appendix LQ-001-OR003 and Background Information and Data (BID)[164], and presented on maps LQ-01-803 to LQ-01-804 (see Volume 4, Off-route effects Map Book).

Geology

6.8.17 This section describes the underlying ground conditions within the Annandale depot area. Recent changes in lithostratigraphic classifications by the BGS have been incorporated where appropriate[165].

6.8.18 Table 24 provides a summary of the geology (made ground, superficial and bedrock units) in the study area.

Table 24: Summary of the geology underlying the land quality study area

Category	Geology	Distribution	Formation description	Aquifer classification
Made ground	Made ground	Associated with tracks, roads, buildings and the railway embankment. Additionally, a	Artificial ground comprising variable deposits of	Not designated

[161] Defined in the SMR as 'mineral body including aggregates, salt, coal and other hydrocarbons, Petroleum Extraction and Development Licence (PEDLs), Shale Protection Area (SPA).

[162] Dumfries and Galloway Council (2014), *Local Development Plan Mineral Assessment.* Available online at: https://www.dumgal.gov.uk/media/17554/Mineral-Assessment-Technical-Paper/pdf/Mineral_Assessment_September_2014.pdf.

[163] Geology of Dumfries and Galloway (GeoD). Available online at: https://geodg.wordpress.com/.

[164] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data, Land quality baseline data. BID LQ-002.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[165] British Geological Survey (2020), *The BGS Lexicon of Named Rock Units.* Available online at: https://webapps.bgs.ac.uk/lexicon/.

Category	Geology	Distribution	Formation description	Aquifer classification
		historical reservoir in an open field to the north of the Mill Forge hotel and wedding venue (north of the A74(M)) may have been infilled.	reworked natural and man-made materials.	
Superficial	Peat	Identified on BGS mapping[166] as a small, isolated patch in the east of the land required for the construction of the Proposed Scheme, and another in the north-east of the study area.	Organic, partially decomposed vegetation.	Not a significant aquifer
Superficial	Alluvium	Small area in the east of the land required for the construction of the Proposed Scheme, extending marginally into the study area.	Organic rich clay, silt, sand and gravel.	Moderate to high productivity
Superficial	River terrace deposits (Undifferentiated)	Small isolated patch associated with Black Sark in the eastern extent of the study area.	Sand and gravel.	Moderate to high productivity
Superficial	Kerr Moraine Formation	Small strip located in the west of the land required for the construction of the Proposed Scheme.	Reddish brown, sandy, silty, clay with gravel, becoming more compact and stony with depth.	Not a significant aquifer
Superficial	Gretna Till Formation	Across the majority of the study area.	Sandy silty clay.	Not a significant aquifer
Bedrock	Sherwood Sandstone Group – Chester Formation – St Bees Sandstone Member	Across the study area.	Conglomerate, interbedded sandstone and mudstone.	High productivity

6.8.19 The 2001/2 foot and mouth disease (FMD) outbreak risk assessment map[167] identifies the study area to lie within a FMD free county. However, local authority and APHA records indicate that two farm burial or pyre sites associated with the 1967/8 and 2001/2 FMD outbreaks are known to be present within the study area. Older unrecorded sites may be present from the 1967/8 outbreak. Similarly, anthrax infected cattle burial sites may be

[166] British Geological Survey (2019), *BGS Geology 50k DiGMapGN-50 WMS, superficial deposits and bedrock geology.* Available online at: https://www.bgs.ac.uk/products/digitalmaps/digmapgb_50.html.

[167] Animal Plant and Health Agency (2001), *Foot and Mouth Disease 2001 – County Status Map 01.10.2001.* Available online at: https://data.gov.uk/dataset/b4b19f56-5cf5-4e89-b06f-62bb3bc88e0f/foot-and-mouth-disease-2001-county-status-map-01-10-2001.

present, generally relating to burials over 50 to 100 years ago. However, no records have been found of such burials. Available records for both FMD and anthrax do not provide an exact location for the burial or pyre sites and other, unrecorded sites may be present.

Radon

6.8.20 Radon is a radioactive gas formed by the radioactive decay of naturally occurring uranium in rocks and soils. The occurrence of radon gas is shown in the BGS Radon Potential Dataset[168].

6.8.21 The study area lies within a lower probability radon area, where less than 1% of homes are estimated to be at or above the action level of 200 becquerels per cubic metre of air (Bq/m^{-3}) for residential properties.

Groundwater

6.8.22 Two aquifer designations have been identified within the study area, as defined by SEPA. These are as follows:

- the St Bees Sandstone Member is recorded as having high aquifer productivity; and
- the alluvium and river terrace deposits are classified as moderate to high productivity aquifers.

6.8.23 The Kerr Moraine Formation, Gretna Till Formation and peat are defined by SEPA as not significant aquifers.

6.8.24 The St Bees Sandstone Member groundwater body within the study area is classified as having an overall good Water Framework Directive (WFD) status.

6.8.25 Table 25 sets out the groundwater designations and abstractions in the land quality study area of 1km from the land required for the construction of the Proposed Scheme within the Annandale depot area.

Table 25: Groundwater designations and abstractions in the land quality study area

Feature	Details
Groundwater Drinking Water Protected Area (DWPA)	The study area is located within the Annan DWPA (ground).
Drinking water supply groundwater abstraction licences	None known.
Private licensed groundwater abstractions	Lochinvar BH34 and BH35, Chapelknowe, Canonbie (Map WR-02-803 G5). Licensed as real estate, renting and business activities.
Registered unlicensed private groundwater abstractions	Wells are marked on the OS map to the south of North Lodge, 475m south-west of the land required for the construction of the Proposed Scheme, and at Watchhill

[168] Available online at: http://www.bgs.ac.uk/radon/hpa-bgs.html. This dataset underpins Public Health England (2007), *Indicative Atlas of Radon in England and Wales*. Available online at: www.ukradon.org/information/ukmaps.

Feature	Details
	close to the River Sark, 850m south-east of the land required for the construction of the Proposed Scheme.

6.8.26 Further information on groundwater within the Annandale depot area is provided in the water resources and flood risk assessment.

Surface water

6.8.27 A number of watercourses and unnamed drains lie within the study area, as described in water resources and flood risk assessment in this section. The main rivers and watercourses, including unnamed streams, tributaries, drains, ponds and culverts located within the study area are described in Volume 5: Appendix WR-001-OR003.

6.8.28 There are no known licensed or unlicensed surface water abstractions or designations in the land quality study area in the Annandale depot area.

6.8.29 Further information on surface water in the study area is provided in water resources and flood risk assessment in this section

Current and historical land use

6.8.30 Current potentially contaminative land uses within the study area include several commercial and industrial sites.

6.8.31 Historical land uses identified within the study area with the potential to have caused contamination include one landfill, two opencast mineral sites and several industrial/commercial sites.

6.8.32 Table 26 to Table 28 summarise the key current and historical contaminative land uses in the Annandale depot area. These are categorised into:

- landfill sites;
- mining and mineral sites; and
- industrial, commercial and other sites identified with a high risk of potential contamination.

Table 26: Current and historical landfill sites located within the study area

Name and area reference	Location	Description
Landfill site (historical) ADEP-33	Woodhouse Mains Landfill, Kirtlebridge. Located 180m to the north of the land required for the construction of the Proposed Scheme.	Historical land use: currently occupied by open field and partially by the A74(M). No dates for first waste input or last waste received are known. Site Operator: Castelli and Gurola. Recorded licence number: WML/W/00202(35/L/93). Maximum input: Large (Equal to or greater than 75,000 and less than 250,000 tonnes per year). Type of waste received: Not recorded.

Table 27: Current and historical mining and mineral sites located within the study area

Name and area reference	Location	Description
Quarry ADEP-24	South of Kirkpatrick-Fleming, adjacent to the land required for the construction of the Proposed Scheme.	No information recorded. Likely to have comprised opencast mining of the St Bees Sandstone Formation. Seen on historical mapping in 1858. Approximately 0.5ha in area.

Table 28: Current and historical industrial, commercial and other sites identified with a high risk of potential contamination located within the study area

Name and area reference	Location	Description
Poultry Breeding and Research Station ADEP-01	Located within the east of the study area and 60m south of the land required for the construction of the Proposed Scheme.	Current land use comprising large agricultural style buildings/sheds, with silos.
Railway land ADEP-02	Located throughout the study area from east to west.	Current land use comprising the West Coast Main Line (WCML) railway.
Former potentially infilled reservoir ADEP-07	Located within the land required for the construction of the Proposed Scheme, north of the Mill Forge hotel and wedding venue.	Former land use. The current status of the reservoir is unknown, and it may have been infilled or covered. The land currently comprises open field.
Storage yard/depot ADEP-05 ADEP-16	Located within land required for the construction of the Proposed Scheme to the north-east of the Mill Forge hotel and wedding venue, adjacent to the WCML railway. Located in Kirkpatrick-Fleming and adjacent to the land required for the construction of the Proposed Scheme.	Current land use. Observable by aerial photography and comprises plant, skips, cabins and other materials. Current land use adjacent to the WCML. Includes storage of many old vehicles observed from current aerial photography.

6.8.33 Contaminants commonly associated with sites in Table 26, Table 27 and Table 28 could include metals, semi-metals, asbestos, organic and inorganic compounds and pathogens. In addition, infilled pits and landfills could give rise to landfill gases, such as methane or carbon dioxide and leachate.

Other regulatory data

6.8.34 The regulatory data reviewed included pollution incidents (major, significant and minor categories), radioactive and hazardous substances consents, ecological sites and environmental permits (previously landfill, integrated pollution control and integrated pollution prevention and control licences).

6.8.35 Two licensed discharges to surface water and seven discharge consents to 'unknown' waterbodies are reported in the study area. None are within the land required for the construction of the Proposed Scheme.

6.8.36 Further details of relevant regulatory data in the Annandale depot area is provided in Section 5 of BID LQ-002-OR003.

6.8.37 Further information on ecological designations within the Annandale depot area is provided in the ecology and biodiversity assessment.

Mineral resources

6.8.38 No minerals resource reserves are listed within the study area in the DGC minerals assessment[169].

6.8.39 The study area is within a coal authority mining reporting area, but it is not within a development high risk area and so mineral resources are not considered as part of the assessment.

Petroleum exploration and development licences/hydrocarbons

6.8.40 There are no current licences for hydrocarbon resources, including coal or coal bed methane exploitation, and no gas exploration licences[170] within the study area. The study area is not within a shale prospective area.

Geoconservation resources

6.8.41 No geological SSSI or LGS sites have been identified within the study area. Therefore, no assessment of geoconservation resources has been undertaken.

Receptors

6.8.42 The sensitive receptors that have been identified within the study area are summarised in Table 29. A definition of receptor sensitivity is given in the SMR.

Table 29: Summary of sensitive receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents at existing properties, and users of schools.	High

[169] Dumfries and Galloway Council (2016), *Local Development Plan, Supplementary Guidance – Mineral Resources.* Available online at: http://www.dumgal.gov.uk/media/17424/LDP-Supplementary-Guidance-Mineral-Resources/pdf/Mineral_resources.pdf.

[170] Oil and Gas Authority, *Onshore Interactive Maps.* Available online at: https://ogauthority.maps.arcgis.com/apps/webappviewer/index.html?id=29c31fa4b00248418e545d222e57ddaa.

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Agricultural land users, railway staff, depot staff, maintenance workers, farm workers, hotel venue guests and staff.	Moderate
Land contamination	Groundwater	High productivity aquifer in the St Bees Sandstone Member.	High
Land contamination	Groundwater	Moderate to high productivity aquifers in the alluvium and river terrace deposits.	Moderate to high
Land contamination	Groundwater	Not significant aquifers in the Kerr Moraine Formation, Gretna Till Formation and peat.	Low
Land contamination	Surface water	Ewes Burn which has a WFD status of poor.	Low
Land contamination	Surface water	Kirkpatrick Burn (tributary of Kirtle Water which has a WFD status of poor).	Low
Land contamination	Built environment	Underground structures and buried services.	Low

Future baseline

Construction (2025)

6.8.43 Volume 5: Appendix CT-004-OR003 provides details of the committed developments within the Annandale depot area that are assumed to have been implemented by 2025.

6.8.44 No committed developments have been identified within this study area that will materially alter the baseline conditions in 2025 for land quality.

Operation (2038)

6.8.45 Volume 5: Appendix CT-004-OR003 provides details of the committed developments within the Annandale depot area that are assumed to have been implemented by 2038.

6.8.46 No committed developments have been identified within this study area that will materially alter the baseline conditions in 2038 for land quality.

Effects arising during construction

Avoidance and mitigation measures

6.8.47 The construction assessment takes into account the mitigation measures described in the draft Code of Construction Practice[171] (CoCP). The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme and

[171] Volume 5: Appendix CT-002-00000, *Draft Code of Construction Practice*.

includes requirements to ensure the effective management and control of work in contaminated areas.

6.8.48 The requirements in the draft CoCP relating to work in contaminated areas will ensure the effective management and control of the work. These requirements include:

- methods to control noise, waste, dust, odour, gases and vapours (Sections 5, 7, 11, 13, 14 and 15);
- methods to control spillage and prevent contamination of adjacent areas (Sections 5, 11 and 16);
- the management of human exposure for both construction workers and people living and working nearby (Sections 5, 7, 11, 13 and 14);
- methods for the storage and handling of excavated materials (both contaminated and uncontaminated) (Sections 6, 7, 11 and 15);
- management of any unexpected contamination found during construction (Sections 11 and 15);
- a post-remediation permit to work system (Section 11);
- storage requirements for hazardous substances such as oil (Sections 5, 11 and 16);
- traffic management to ensure that there is a network of designated site haul routes to reduce compaction/degradation of soils (Sections 5, 6 and 14);
- methods to monitor and manage flood risk and other extreme weather events which may affect land quality during construction (Sections 5 and 16); and
- methods to manage discovery of unknown animal burial pits (Section 6).

6.8.49 The draft CoCP will require that prior to and during construction, a programme of further detailed investigations, which may include both desk-based and site-based work, takes place in order to confirm the full extent of areas of contamination. It also requires a risk assessment to be undertaken to determine what, if any, site-specific remediation measures are required to allow the Proposed Scheme to be constructed safely and to prevent harmful future migration of contaminants. The investigation and assessment of potentially contaminated sites will be undertaken in accordance with Scottish guidance including; Planning Advice Note (PAN) 33[172] and Environmental Protection Scotland's guidance[173] on land contamination and development, as well as British Standard BS10175[174] and BS8576[175]. In addition, a licence will need to be obtained from the Coal Authority for any works that disturb coal seams or mine workings.

6.8.50 A remedial options appraisal will be undertaken to define the most appropriate remediation techniques, where appropriate. This appraisal will be undertaken based on multi-criteria

[172] Scottish Government (2000), *Planning Advice Note (PAN) 33: Development of Contaminated Land.*

[173] Environmental Protection Scotland (2019), *Land contamination and development*. Available online at: https://www.ep-scotland.org.uk/wp-content/uploads/2019/09/ConLanDevGuide_12-Aug19-FINAL.pdf.

[174] British Standard (2011), *BS10175+A2:2017 Investigation of Potentially Contaminated Sites*.

[175] British Standard (2013), *BS8576:2013 Guidance on Investigations for Ground Gas*.

attribute analysis that considers environmental, resource, social and economic factors in line with the framework set out by the Sustainable Remediation Forum UK[176]. The preferred option will then be developed into a remediation strategy.

6.8.51 Contaminated soils excavated within the site, where reasonably practicable, will be treated to remove or render contamination inactive and reused within the Proposed Scheme where needed and suitable for use. Treatment techniques are likely to include stabilisation, soil washing and bio-remediation. Contaminated soil removed off-site will be taken to a soil treatment facility, another construction site (for treatment and reuse) or to an appropriately permitted landfill.

Assessment of impacts and effects

6.8.52 Construction of the Proposed Scheme in this area will require earthworks, dewatering of excavations, utility diversions, and ground stabilisation and other activities, including road infrastructure works. These aspects of the Proposed Scheme, along with other construction features, are shown on the Volume 4, Off-route effects Map Book, CT-05 Map Series.

Land contamination

6.8.53 In line with the assessment methodology, as set out in the SMR, an initial screening process has been undertaken to identify areas of current or historical contaminative use within the study area and to consider which of these areas might pose contaminative risks in relation to the Proposed Scheme. Sites that present a low risk have not been taken further in the assessment. Any moderate to higher risk sites have been taken forward to more detailed risk assessments, in which the potential risks are assessed more fully. All areas assessed are shown on Volume 4, Off-route effects Map Book, maps LQ-01-803 to LQ-01-804 and those considered as potentially posing a risk in relation to the Proposed Scheme are labelled with a reference number.

6.8.54 In the Annandale depot area, four sites remain following initial screening to go through to detailed risk assessment and require CSM. The sites that have undergone the more detailed risk assessments are historical or current industrial sites.

6.8.55 CSM have been produced for those areas taken to detailed risk assessments. The following factors determine the need for detailed risk assessments:

- whether the site is located within the land required for the construction of the Proposed Scheme;
- the vertical profile of the Proposed Scheme in the vicinity of the site;
- the presence of underlying sensitive groundwater aquifers or nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

[176] Sustainable Remediation Forum UK (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation.*

6.8.56 Clusters of potentially contaminated sites of a similar nature have been grouped and assessed together, where appropriate.

6.8.57 A simple summary of the baseline CSM is provided in Table 30. A more detailed assessment of baseline risk is provided in Volume 5: Appendix LQ-001-OR003. The baseline risks quoted are those before any mitigation is applied. The assessed baseline risk is based on the information provided at the time of the assessment. Where limited information is available, the assessment is based on precautionary, worst-case assumptions and may, therefore, report a higher risk than that which actually exists. A screening assessment of the effects of contamination has been completed by comparing the detailed CSM developed for potential contaminated areas at baseline with construction and post-construction stages. For clarity, 'on-site' means within the land required for the construction of the Proposed Scheme and 'off-site' refers to land beyond this boundary, but within the study area.

6.8.58 Not all sites referenced in Table 26 to Table 28 have been taken further in the assessment following the initial screening.

Table 30: Summary of baseline CSM for sites which may pose a contaminative risk in relation to the Proposed Scheme

Category	Site Group/ID	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
On-site	Railway land ADEP-02	Low to moderate/low	Moderate/low	N/A	N/A	Low
On-site	Storage yard ADEP-05	Low to moderate/low	Moderate/low	N/A	N/A	Low
On-site	Potentially infilled reservoir ADEP-07	Low to moderate/low	Moderate/low	N/A	N/A	Low
Off-site	Depot ADEP-16	Moderate/low	Moderate/low	Low	N/A	Low

N/A means receptor/pathway not present

Temporary effects

6.8.59 In order to identify potential temporary effects, the baseline and construction CSM have been compared to determine the change in level of risk at receptors during the construction stage, and thus to define the level of effect at the construction stage.

6.8.60 Where there is no change between the main baseline risk and the main construction risk, the temporary effect significance is deemed to be neutral even if the risk is deemed to be high. For example, this will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is off-site (i.e. outside the area required for the construction of the Proposed Scheme).

6.8.61 A worsening risk at the construction stage compared to baseline will result in a negative effect, and conversely, an improvement will result in a positive effect. The assessment assumes that contamination will be controlled through the general measures in the draft CoCP.

6.8.62 All of the sites have been assessed for the change in impact associated with the construction stage of the work and were found to have no significant effects.

6.8.63 In the event that unexpected contamination is encountered during the construction of the Proposed Scheme in the Annandale depot area, this will be remediated as described in the draft CoCP resulting in an overall beneficial effect.

6.8.64 The application of the measures set out in the draft CoCP makes it unlikely that there will be significant adverse effects, but it is considered that there may still be some temporary minor adverse effects during the construction period from ground disturbance in these areas. These temporary minor adverse impacts at the construction stage are not regarded as significant in line with the methodology set out in the SMR.

6.8.65 Construction compounds located within the study area may include the storage of potentially hazardous substances, such as fuels and lubricating oils and may also be used for temporary storage of potentially contaminated soils. Control and mitigation measures are contained within the draft CoCP including measures to manage the risks associated with the storage of such materials resulting in no significant effects.

Permanent effects

6.8.66 In order to identify potential permanent effects associated with the construction of the Proposed Scheme, a screening assessment has been undertaken comparing the baseline and post-construction CSM to assess the permanent (post-construction) effects.

6.8.67 The magnitude of the permanent effects and their significance has been determined by assessing the change in risk between the main baseline risk and the main post-construction risk. Therefore, where there is no change between the main baseline risk and the main post-construction risk, the permanent effect significance is deemed to be neutral even if the risk is assessed to remain as high. This will be the case where the construction of the Proposed Scheme will not alter the risks from an existing potentially contaminated site that is outside the land required for the construction of the Proposed Scheme. As noted above, a worsening will result in negative effects and an improvement will result in positive effects.

6.8.68 There are no post-construction stage significant effects identified within the study area.

6.8.69 Additional site-specific permanent remediation measures, which could focus on source removal, pathway breakage or receptor protection, will be developed during the detailed design stage if required. These measures will make sure risks will be controlled to an acceptable level.

Minerals resources

6.8.70 There are no mineral resources defined in the adopted minerals plan within the study area and so mineral resources are not considered as part of the assessment.

Geoconservation sites

6.8.71 No geoconservation areas such as SSSI or LGS are present within the study area and so these are not considered as part of the assessment.

Other mitigation measures

6.8.72 No additional measures are considered necessary to mitigate risks from land contamination during the construction stage beyond those that are set out in the draft CoCP and/or instigated as part of the site-specific remediation strategies. These strategies will be developed at the detailed design stage, if required. These measures will ensure that risks to people, property and environmental receptors from contaminants in the ground will be controlled such that they will not be significant. For example, measures might include excavation and treatment of contaminated soils or controls to manage movement of ground gas and leachate.

Summary of likely residual significant effects

6.8.73 Based on the information currently available, and with the application of the mitigation measures detailed above, no likely significant residual effects are anticipated with respect to land quality.

6.8.74 Where remediation at contaminated land sites is undertaken there may be significant beneficial residual effects.

Cumulative effects

6.8.75 Based upon the review of committed development sites, it is assessed that there will be no significant cumulative effects arising from the construction of the Proposed Scheme with respect to land quality.

Effects arising from operation

6.8.76 Users of the Proposed Scheme (i.e. rail depot workers) will be at all routine times within a controlled environment (i.e. under operational management plans and risk assessments), and have therefore, been scoped out of the assessment.

Avoidance and mitigation measures

6.8.77 Maintenance and operation of the Proposed Scheme will be in accordance with environmental legislation and good practice. Spillage and pollution response procedures

similar to those to be outlined in the draft CoCP will be established for all high risk activities and employees will be trained in responding to such incidents.

Assessment of impacts and effects

6.8.78 The Proposed Scheme within the Annandale depot area will include a railway depot, a wastewater treatment plant (WWTP) and a traction sub-station. A railway depot, WWTP and sub-station can, in principle, be a source of contamination through accidental discharge or leaks of coolant, wastewater and fuel. However, in common with other modern infrastructure development, secondary containment appropriate to the level of risk will be included in the installed design.

6.8.79 The operation of the trains may give rise to minor contamination through leakage of hydraulic or lubricating oils. However, such leakage or spillage is expected to be very small and unlikely to result in significant contamination.

Other mitigation measures

6.8.80 No other mitigation measures are expected to be required beyond what has already been outlined relating to land quality within the study area.

Summary of likely residual significant effects

6.8.81 No significant residual effects are anticipated as a result of the operation of the Proposed Scheme.

Cumulative effects

6.8.82 There are anticipated to be no significant cumulative residual effects from the operation of the Proposed Scheme.

Monitoring

6.8.83 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme. Requirements for monitoring relating to land quality will be determined as part of the investigation, treatment and validation of contamination on a site-specific basis as part of the detailed design process. During the operational phase, monitoring works for groundwater will continue where required. Monitoring requirements may include water quality, air quality and/or landfill bulk and trace gases, depending on the site being considered.

6.9 Landscape and visual

Introduction

6.9.1 This section of the report presents the assessment of the likely significant landscape and visual effects within the Annandale area. It summarises the baseline conditions found within and around the route of the Proposed Scheme and describes the likely impacts and significant effects during construction and operation on landscape and visual receptors.

6.9.2 The operational assessment section refers not just to the running of the trains, vehicles on roads and any associated lighting but also the presence of the new permanent infrastructure associated with the Proposed Scheme.

6.9.3 Engagement with Dumfries and Galloway Council (DGC) and NatureScot has been undertaken; however, feedback has not been received from DGC. The purpose of this engagement was to discuss the assessment methodology, the extent of the landscape and visual study area, the extent of the landscape character boundaries and the locations of visual assessment and verifiable photomontage viewpoints.

6.9.4 Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in the Volume 5, Landscape and visual Map Book and Volume 5: Appendix LV-001-0R003, which comprises the following:

- Part 1: Engagement with technical stakeholders;
- Part 2: Landscape character assessment;
- Part 3: Visual assessment;
- Part 4: Assessment matrices; and
- Part 5: References.

6.9.5 The Proposed Scheme is described in Section 6.1. Maps showing the location of the key environmental features (Map Series CT-10), and the key construction (Map Series CT-05) and key operational (Map Series CT-06) elements of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. Map Series CT-06 also shows the locations of landscape and visual impact mitigation measures.

6.9.6 Map series LV-03, LV-04 and LV-02 contained in Volume 5, Landscape and visual Map Book, show the viewpoints that will be significantly affected by the construction (Map Series LV-03) and operation (Map Series LV-04) phases and, landscape character areas (LCA) that will be significantly affected at the construction and operation phases (Map Series LV-02).

6.9.7 A separate, but related, assessment of effects on the setting of heritage assets is presented in Section 6.6.

Scope, assumptions and limitations

6.9.8 The scope, assumptions and limitations for the landscape and visual assessment are set out in full in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report (SMR)[177].

6.9.9 Surveys were undertaken during the following periods to inform the landscape and visual assessment:

- summer surveys in September 2019, May 2021; and
- winter surveys in January and March 2021.

6.9.10 Scotland has statutory rights for access and recreation by responsible users under the Land Reform (Scotland) Act 2003. Local authorities can identify certain key public access routes as core paths. Access was limited to representative viewpoints located on adopted public roads and along publicly accessible core paths, due to a number of factors including national restrictions associated with COVID-19. In addition, feedback regarding representative viewpoints has not been received from DGC. Therefore, a precautionary approach has been applied whereby the assessment has been undertaken using alternative, appropriate sources of information and professional judgement. This constitutes a 'reasonable worst-case' basis for the subsequent assessment.

6.9.11 The extent of the study area has been informed by construction and operational phase zones of theoretical visibility (ZTV). The ZTV have been produced in line with the methodology described in the SMR and are an indication of the theoretical visibility of the Proposed Scheme. In some locations, extensive vegetation cover means that the actual extent of visibility will be substantially less than that shown in the ZTV, and professional judgement has been used to further refine the study area to focus on likely significant effects.

6.9.12 Tall construction plant (for example cranes and piling rigs) is excluded from the ZTV for the construction phase, as there is a great degree of variability in the extent and timeframes of the visibility of construction activity and plant. Overhead line equipment rarely gives rise to significant effects if it is the only element visible and has, therefore, been excluded from the ZTV to give a better indication of the possible spread of significant effects to aid the assessment. However, overhead line equipment as well as tall construction plant are taken into account in the assessment of effects on LCAs and visual receptors.

6.9.13 Landscape and visual receptors within approximately 1.5km of the centre of the Proposed Scheme have been assessed as part of the study area. Where important receptors fall just beyond the ZTV, professional judgement has been used in recording and assessing these. Long-distance views of up to 2km have been considered at settlement edges, such as at Gretna Green and Kirkpatrick-Fleming.

[177] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

6.9.14 This assessment is based on preliminary design information and makes reasonable worst-case assumptions on the nature of potentially significant effects where these can be substantiated. The assessment of visual effects during construction covers the situation in winter at peak activity. The assessment of operational visual effects covers the situation in winter and summer of year 1 and summer of year 15 and year 30. The assessment of landscape effects is undertaken for the construction phase and for the operational phase at year 1, year 15 and year 30. The landscape assessment does not consider seasonal variations e.g. winter/summer, since these do not affect character.

6.9.15 Professional judgements on landscape value are provided in the baseline descriptions and judgements on susceptibility of the landscape to the Proposed Scheme and overall landscape sensitivity are provided as part of the assessment of effects on each significantly affected LCA.

6.9.16 The assessment has been carried out on the basis that design of structures will, insofar as reasonably practicable, integrate with existing skyline features and will make use of a simple, clean and coherent palette of materials to help structures fit in the landscape.

6.9.17 It has been assumed that all vegetation within the land required for the construction of the Proposed Scheme will be removed during construction unless stated otherwise. This excludes areas included only for the purpose of mitigation planting. Removed vegetation will be reinstated where feasible. The assessment has been based on the assumption that the existing hedgerow pattern would be reinstated and would provide screening and integration benefits by year 15.

6.9.18 With respect to utilities, particularly raising or lowering of pylons, re-stringing of cables and utility decommissioning, it has been assumed that the majority of existing vegetation can be retained. Vegetation will be removed along new utility lines, based on easement guidance from specific utility companies. All vegetation removed during utilities construction work will be reinstated insofar as reasonably practicable. Works associated with underground utilities within highways will follow the principles set out in the draft Code of Construction Practice (CoCP)[178] and existing street trees and property boundary vegetation will be retained insofar as reasonably practicable.

Environmental baseline

Existing baseline

Landscape baseline

6.9.19 The Proposed Scheme will be located within a rural setting, on gently rising agricultural land interspersed with farmsteads and cottages. The location is within a key Scotland-England

[178] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

transport corridor accommodating the West Coast Main Line (WCML), the A74(M) and the B7076.

6.9.20 The study area extends from Gretna and Gretna Green to the south-east, westwards from the valley of the River Sark and to the village of Kirkpatrick-Fleming in the north-west. To the west beyond the A74(M), land falls gently to the valley of Kirtle Water. Further to the south-west are the lower-lying mosslands, the floodplain of the River Esk and the Solway Firth. Coastal views are available from higher ground in the east.

6.9.21 The landscape is predominantly open land with large fields enclosed by hedges. There are frequent belts of trees to both sides of the A74(M), and hedges and small woodlands along the B7076. These road transport corridors with passing traffic are locally prominent, with varying levels of visibility dependant on the presence of cuttings, embankments or intervening vegetation.

6.9.22 Settlements within the study area comprise small villages, farms and cottages and small business premises. Gretna Green is located immediately north of the Scotland-England border, with the village of Kirkpatrick-Fleming to the north of the study area. Both have local amenities and are linked by the B7076 and served by junctions on the A74(M). Gretna Green motorway services is accessed from the A74(M) by both northbound and southbound traffic and includes a Days Inn hotel. The Mill Forge hotel and wedding venue is accessed from the B7076 north of Kirkpatrick-Fleming.

6.9.23 The study area includes a number of core paths established by DGC including the Bensmoor Wood to Douglas Steading Core Path (path no 325), the Errolston to Springfield Core Path (path no 326) and the Gretna service area to Gretna Core Path (path no 517). DGC also promotes other recreational on and off-road routes to walkers and cyclists. The study area includes the Quintinshill and the River Sark circular walk starting and ending at Gretna. There are two National Cycle Network (NCN) routes, 7 and 74 connecting Glasgow with Gretna and beyond to Carlisle, to the south of the study area.

6.9.24 The LCAs have been determined as part of an integrated process of environmental characterisation, informed by a review of historic landscape mapping, historic landscape characterisation datasets and the outcome from other topics including ecological assessments. Use has been made of published landscape character assessments and a wide range of supporting GIS data, aerial photography and Ordnance Survey mapping, plus desk-study and fieldwork. Landscape character assessments reviewed include the relevant Scottish Natural Heritage National Landscape Character Types (LCT)[179] and the landscape

[179] Scottish Natural Heritage (2019), *Scottish Landscape Character Types Map and Descriptions*. Available online at: https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions.

character assessment(s) prepared as supplementary guidance to the DGC Local Development Plan[180].

6.9.25 These published LCT have been adapted for this assessment to provide LCAs of an appropriate, consistent scale. Minor amendments have been made to some published LCT boundaries to reflect existing conditions, as verified on-site, or to draw out specific aspects susceptible to change from the Proposed Scheme.

6.9.26 For the purposes of this assessment, the study area for the Proposed Scheme has been subdivided into five LCAs. Full descriptions of these LCAs are provided in Volume 5: Appendix LV-001-OR003.

6.9.27 Three of the five LCAs will not be significantly affected by the Proposed Scheme due to distance from the Proposed Scheme and the presence of intervening vegetation, which will contain landscape effects to mostly within 1.5km of the Proposed Scheme.

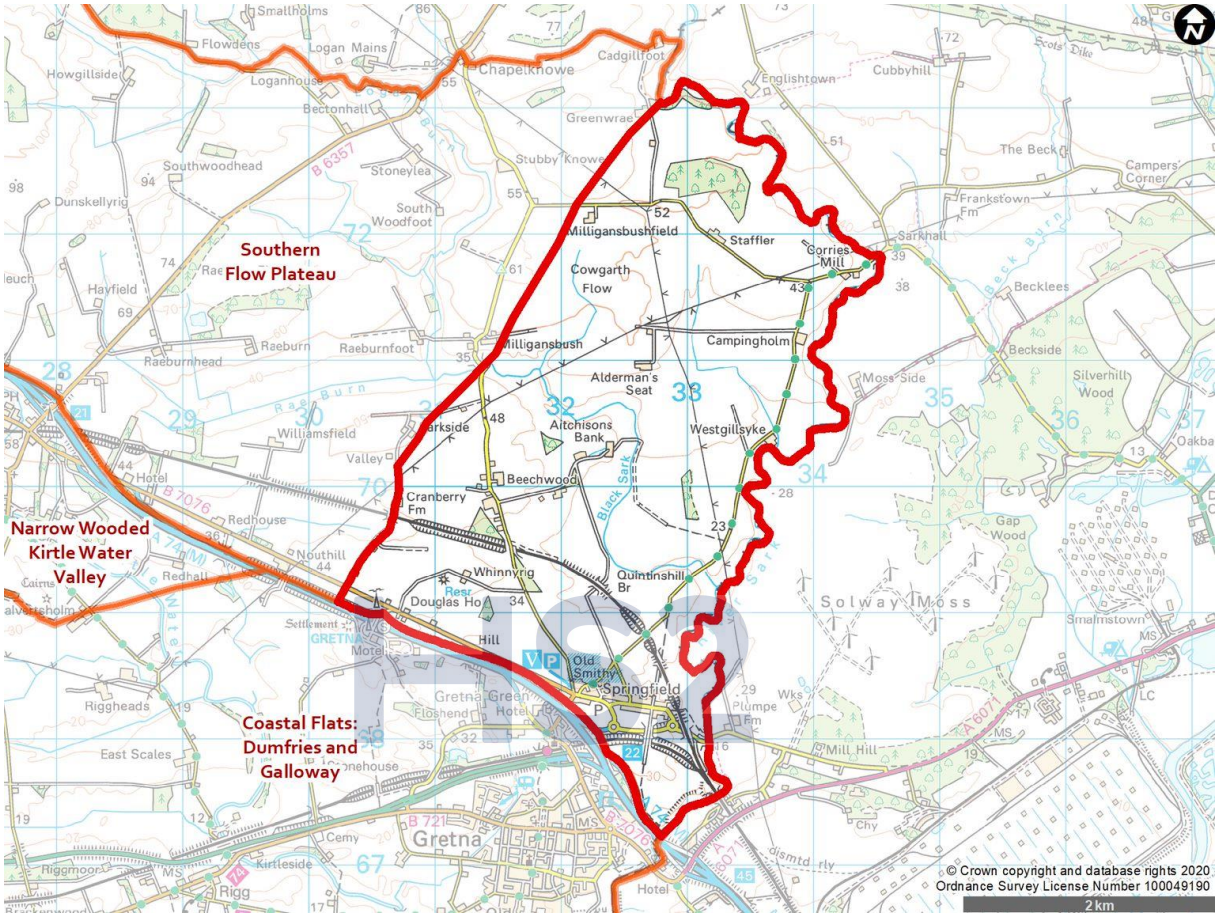
6.9.28 A summary of the two LCAs that will be significantly affected within the study area is shown in the figures and described below.

[180] Dumfries and Galloway Council (2017), *Local Development Plan – Part 1 Wind Energy Development: Development Management Considerations. Appendix 'C' Dumfries and Galloway Wind Farm Landscape Capacity Study*. Available online at: https://www.dumgal.gov.uk/media/18596/Dumfries-and-Galloway-Wind-Farm-Land-Capacity-Study-Appendix-C/pdf/Wind_Energy_Appendix_C_Landscape_June_2017.pdf.

Significantly affected landscape character areas

River Sark Flats

Figure 16: River Sark Flats LCA



6.9.29 The River Sark Flats LCA lies north of the A74(M) corridor and Gretna Green, and to the west of the River Sark on the Scotland-England border. The terrain is level or gently rolling, rising from Gretna on Solway Firth to the higher Flow Plateau in the north, as shown in Figure 16.

6.9.30 There is a simple pattern of large fields enclosed by hedgerows or fences. Cattle grazing on improved pasture predominates, with some arable fields. Settlement is limited to a few large farms and cottages that are dispersed evenly across the landscape. The route of the WCML passes through the southern part of this LCA, with the Carlisle Line linking Gretna Green to Glasgow diverging from the WCML in the south-west of the LCA and continuing westwards towards Annan. The road network is sparse. The B7076 runs close to the south-west boundary of the LCA. Both road and rail infrastructure are well-integrated into their rural setting by the gently undulating landform and existing vegetation. As a result, infrastructure elements are not prominent within this LCA. NCN route 7 follows close to the eastern boundary of the LCA and a number of core paths are present closer to Gretna. DGC also promotes other off and on-road walking routes, including the Quintinshill and River Sark circular route, in local tourism brochures.

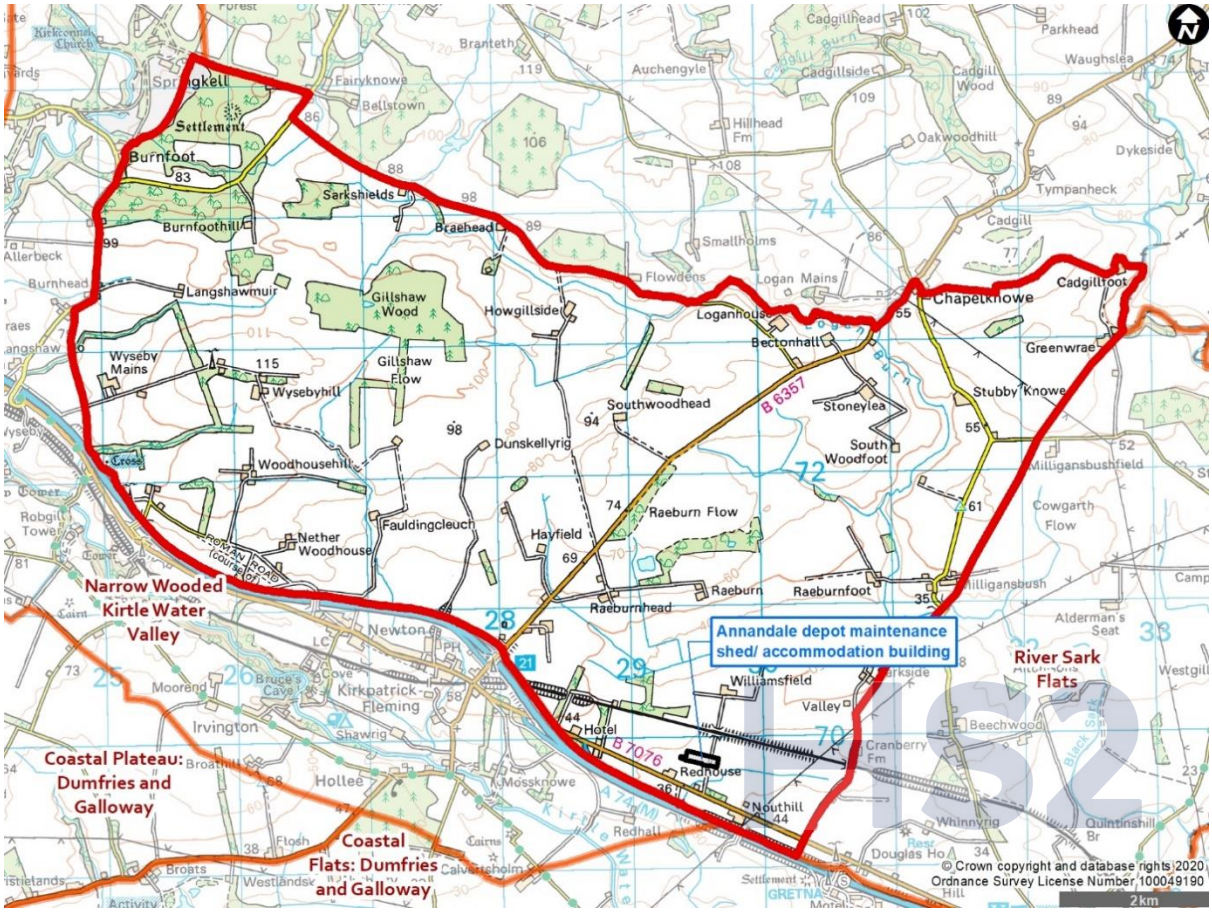
6.9.31 Pockets of tranquillity are found in the north of this LCA and in particular along the course of the River Sark and its tributary burns, which are often marked by broadleaved trees, scrub and narrow woodlands. Hedgerow trees can be locally distinctive and strong onshore winds create wind-bent trees in the more exposed lower-lying land.

6.9.32 North of the WCML, views are long and wide with expansive skies. Where present, narrow shelterbelts and woodlands curtail the sense of openness. Two overhead power lines crossing the LCA and connecting to a sub-station on the higher land are a prominent feature in many views. The wind turbines associated with Beck Burn windfarm at Solway Moss are noticeable in views to the east. In the south, views extend to Solway Firth and beyond to the Cumbrian Fells.

6.9.33 The River Sark Flats LCA is assessed as having an overall medium landscape value based on its intact pastoral landscape, woodland cover and expansive skies, together with sparse settlements and well-integrated infrastructure elements.

Southern Flow Plateau

Figure 17: Southern Flow Plateau



6.9.34 The Southern Flow Plateau LCA comprises land to the north-west of Gretna Green and the A74(M). The terrain is largely level or gently undulating as it rises from the Solway Firth in the south-west to the higher upland fringe in the north-east, as shown in Figure 17.

6.9.35 This is a predominantly rural landscape of medium-scale fields of grazing pasture with some arable farming. Field boundary hedgerows line the minor roads, though elsewhere fields are delineated by post and wire fences. To the north of the LCA, plantation woodlands and shelterbelts, including some ancient woodlands, are important focal points in this rural landscape, although in the south, woodland cover is limited. Many small burns, areas of standing water, marshy pastures and raised bogs add to the biodiversity and visual interest of the LCA. Of particular note are Raeburn Flow Site of Special Scientific Interest (SSSI) and Springkell Non-Inventory Designated Landscape.

6.9.36 Settlement consists of large farms dispersed throughout the landscape. Listed farmhouses and a listed barn make a limited contribution to landscape character due to their disparate locations within the LCA. The road network is sparse. Much of the road and rail transport infrastructure is located at the south-western edge of the LCA; the B7076 and the A74(M) lie close to the WCML. The WCML is in shallow cutting and is well integrated into the landscape by lineside vegetation and woodland blocks. Access to farmhouses and cottages is via local lanes and unsurfaced roads. Two overhead power lines cross the north and south-eastern extents of the LCA. To the north, away from the B7076 and the WCML, tranquillity levels are high and the expansive and open views across the landscape create a perception of remoteness.

6.9.37 The Southern Flow Plateau LCA is assessed as having an overall **medium** landscape value based on the well maintained agricultural landscape, the presence of habitats of value including ancient woodland, and the presence of infrastructure elements.

Visual baseline

6.9.38 A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are numbered to identify their locations and are shown on the viewpoint location maps (see Volume 4, Off-route effects Map Book, Map Series LV-03 and LV04). In each case, the middle number (xxx.**xx**.xxx) identifies the type of receptor that is present in this area – 01: Protected views (none within this area), 02: Residential, 03: Recreational[181], 04: Transport, 05: Hotels/healthcare/schools and 06: Employment.

6.9.39 The landform of the Annandale area falls gently from a highpoint north of Kirkpatrick-Fleming, to lower land north and west of Gretna Green, allowing for some expansive views. Medium-scale fields are enclosed by hedgerows and hedgerow trees and there are some small woodlands that control and filter views. There are also narrow belts of trees and shrubs along the A74(M) and to either side of the WCML. This vegetation in combination with small-scale variations in landform filter the availability and extent of views. From higher land north of the WCML, longer views to the south-west can include Solway Firth and beyond to the Solway Coast Area of Outstanding Natural Beauty and Lake District National Park.

[181] Reference to specific civil parish numbers for footpaths is provided where available, otherwise the adjacent road name is used as a reference to the footpath.

6.9.40 In the predominantly agricultural area between Kirkpatrick-Fleming and Gretna Green, settlement is limited to scattered farms and cottages. Residential views from farms and cottages are rural and typically extend across pastoral and arable fields, although garden vegetation, hedgerows and small areas of woodland can curtail views in this gently undulating landscape.

6.9.41 Views experienced by hotel guests vary dependant on location, type of accommodation and ancillary events offered. Visitors to venues such as Smith's Hotel at Gretna Green using guest rooms in a multi-storey building may have potentially open views to higher land in the north and west and over Solway Firth to the south and west. Other hotel accommodation in the study area such as The Mill Forge hotel and wedding venue is based on single or two-storey buildings constructed in the local style and from local materials. Hotels also host weddings and related events in both indoor and garden settings for ceremonies and photography.

6.9.42 Views from recreational routes are often restricted by field hedgerows and trees, with more expansive views only available over low hedges or fenced field boundaries. Bensmoor Wood to Douglas Steading Core Path, Errolston to Springfield Core Path and Gretna service area to Gretna Core Path are locations where longer views are possible, as well as from Quintinshill and the River Sark promoted walking route and along NCN routes 7 and 74. Views from the B7076 and from lanes in lower-lying areas south of the B7076 and the A74(M) corridors can be restricted by intervening vegetation. From higher land to the north-east wider, more open views over the study area are possible.

Future baseline

Construction (2025)

6.9.43 Volume 5: Appendix CT-004-OR003 provides details of the additional developments in the Annandale area that are assumed to have been implemented by 2025. No committed developments of relevance for landscape and visual amenity have been identified in this study area that will materially alter the baseline in this area.

Operation (2038)

6.9.44 Volume 5: Appendix CT-004-OR003 provides details of the additional developments in the Annandale area that are assumed to have been implemented by 2038. No committed developments of relevance for landscape and visual amenity have been identified in this study area that will materially alter the baseline in this area.

Temporary effects arising during construction

6.9.45 As is commonplace with major infrastructure works, the scale of the construction activities means that works will be visible from many locations and will have the potential to give rise to significant temporary effects that cannot practicably be mitigated. Such effects will vary over the construction period depending on the intensity and scale of the works at the time. The assessment of landscape and visual effects has been based on the activities occurring

during the peak construction phase, which is defined as the period during which the main construction works will take place, including the presence of compounds, main earthworks and structure works.

6.9.46 The effects associated with the peak construction stage in this area are generally considered to be medium-term, based on the indicative construction programme in Section 6.1. Effects during other stages of works are likely to be less intensive due to less construction equipment being required at the time and a reduced intensity of construction activity.

6.9.47 Section 6.1 also sets out the key permanent features of the Proposed Scheme and describes the construction compounds and associated temporary works that have been considered in this assessment.

Avoidance and mitigation measures

6.9.48 Measures that have been incorporated into sections 12 and 14 of the draft CoCP to avoid or reduce landscape and visual effects, where reasonably practicable, during construction include the following:

- avoidance of unnecessary tree and vegetation removal, and protection of existing trees in accordance with BS 5837: Trees in relation to design, demolition and construction[182];
- use of well-maintained hoardings and fencing;
- prevention of damage to the landscape features adjacent to the construction sites due to movement of construction vehicles;
- designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses; and
- replacement of any trees intended to be retained should they die as a consequence of nearby construction works.

6.9.49 Implementation of these measures has been taken into account in the assessment of the construction effects.

Assessment of temporary impacts and effects

6.9.50 The most apparent changes to the landscape and to the views experienced by visual receptors during construction will relate to the presence of construction plant, compounds and soils and material storage and stockpiling. Key construction activities that will give rise to the most apparent changes to landscape and visual receptors are: the removal of vegetation; closure or diversion of roads and core paths; the installation and use of construction compounds including plant and vehicle movements and the progressive construction of the Proposed Scheme. Open access to and connectivity within the wider countryside granted under the Land Reform (Scotland) Act 2003 will be reduced.

[182] British Standard (2012), *BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations*.

6.9.51 Non-significant effects are reported in Volume 5: Appendix LV-001-0R003.

Landscape assessment

6.9.52 The LCAs set out in Table 31 will be significantly affected during construction of the Proposed Scheme.

Table 31: Summary description and assessment of effects on LCA

Location	
River Sark Flats Construction activity in the adjacent Southern Flow Plateau LCA will indirectly affect the wider setting of this LCA. The southern section of the River Sark Flats LCA of **medium** value will be directly affected by construction works in connection with modifications to WCML to accommodate the Proposed Scheme, construction of the southern reception tracks, Cranberry Farm accommodation overbridge, a pumping station and associated storage tank. Construction activity in the adjacent Southern Flow Plateau LCA will indirectly affect the wider setting of this LCA. The scale of construction activity and changes to landform and landcover will affect the character of the predominantly rural setting and gently rising landform across a small proportion of this LCA. However, construction activity will be in the context of existing road and rail infrastructure elements in the southern part of the LCA. The presence of construction activity will reduce the extent of local open access land although no core paths will be directly affected or diverted during construction. In the northern parts of the LCA, the agricultural and river valley landscape combined with few detracting features creates a perception of relative tranquillity and remoteness. However, this is moderated in the south by the presence of existing road and rail infrastructure. The lower levels of tranquillity in the vicinity of the WCML and the B7076, will be further reduced by the presence of construction vehicle movements and activities associated with Quintinshill Sidings satellite compound. Lighting at Quintinshill Sidings satellite compound, in the context of a largely dark-sky environment, and the presence of construction activity will be out of character with the existing rural landscape setting. Due to the **medium** value, including relative remoteness and overall rural character together with the presence of transport infrastructure, the landscape has a **medium** susceptibility to change arising from the Proposed Scheme. The loss of landscape features and the introduction of uncharacteristic elements will be at considerable variance with the rural landscape and construction activity will indirectly affect the wider setting of this LCA. Construction activity will result in a **medium** magnitude of change. The **medium** magnitude of change for the River Sark Flats LCA and its **medium** sensitivity will result in a **moderate** adverse significant effect.	Level of effect: **Moderate** adverse (significant)
Southern Flow Plateau The southern part of the Southern Flow Plateau LCA of **medium** value will be directly affected by construction works in connection with construction of Williamsfield Farm access diversion, Annandale depot including depot sidings, maintenance shed and accommodation building, depot sidings underpass, the northern reception track, the B7076 realignment and modifications to the WCML. Cranberry Farm accommodation overbridge satellite compound, Annandale depot main compound and temporary earthworks stockpiles will be introduced into the agricultural landscape. Low levels of	Level of effect: **Moderate** adverse (significant)

Location	
tranquillity in the vicinity of the WCML, the B7076 and the A74(M) will be further reduced by construction activity and construction vehicle movements. The severance of the existing field patterns, removal of hedgerows, individual mature trees and pockets of woodland including ancient woodland will be noticeable. Construction activity will affect the landscape setting of Grahamshill Farmhouse and Steading (the Mill Forge hotel and wedding venue) Grade B listed building. Short sections of Ewes Burn will be realigned, with the removal of some streamside trees and vegetation. Cranberry Farm accommodation overbridge satellite compound and Annandale depot main compound will be lit at night. This new area of lighting will be an additional light source in a largely unlit environment but will be in the context of lighting at Kirkpatrick-Fleming and lighting from vehicles using the B7076 and the A74(M). Access and connectivity within the wider countryside, granted under the Land Reform (Scotland) Act 2003, will be reduced within the area of Annandale depot. Due to the **medium** value including relative remoteness and overall rural character together with the presence of transport infrastructure, the landscape has a **medium** susceptibility to change arising from the Proposed Scheme. The loss of landscape features and the introduction of construction activity will represent uncharacteristic changes across a proportion of the character area. Construction activity associated with the Proposed Scheme will result in a **medium** magnitude of change. The **medium** magnitude of change for the Southern Flow Plateau LCA and its **medium** sensitivity will result in a **moderate** adverse significant effect.	

Visual assessment

Introduction

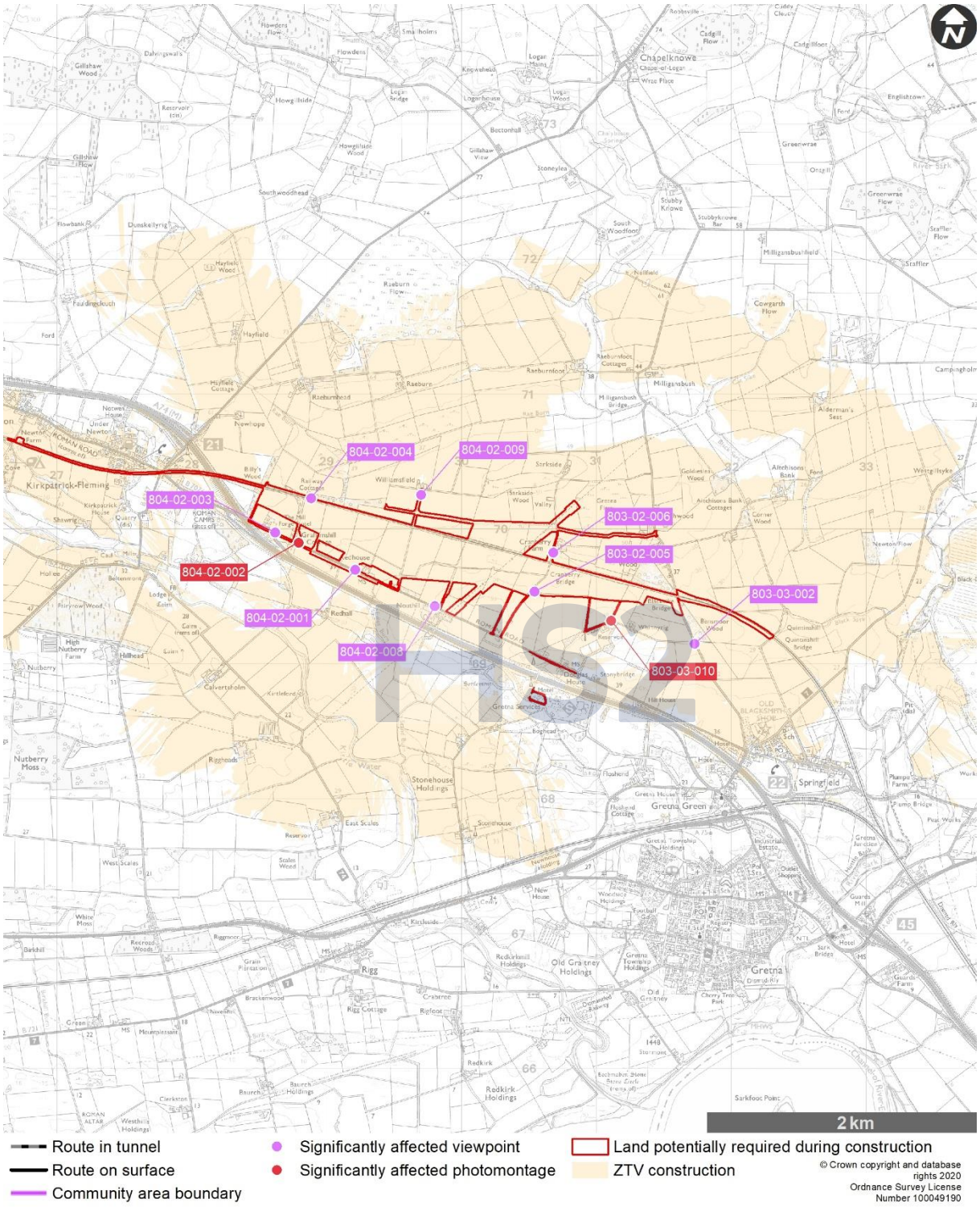
6.9.53 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken for the winter period, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities may be reduced during summer when vegetation, if present in a view, will be in leaf. Where visual receptors are predicted to experience significant effects at night-time arising from additional lighting, these are also presented in this section.

6.9.54 Where a viewpoint represents multiple types of receptor, the assessment is based on the most sensitive receptor. Effects on other receptor types with lower sensitivity will be lower than those reported.

6.9.55 The visual assessment has identified locations where continuous night working and/or overnight working during construction will result in significant effects on visual receptors (summarised in Table 5 and described in detail in Volume 5: Appendix LV-001-OR003 Part 3).

6.9.56 Table 32 describes the potentially significant visual effects during the construction phase. Viewpoint locations are shown in Map Series LV-03 in Volume 4, Landscape and visual Map Book.

Table 32: Construction phase significant visual effects



View north-west from Quintinshill and the River Sark circular walk (High sensitivity receptors) (VP 803-03-002)	
Users of the promoted recreational route of **high** susceptibility and with **medium-high** value views, will experience a noticeable change to middle and far-distance views due to the presence of large-scale construction works including the modification of the WCML, and construction of the southern reception tracks and Cranberry Farm accommodation overbridge. There will be close views of construction traffic using the minor road between Gretna Green and Blacksike Bridge. Cranberry Farm accommodation overbridge satellite compound, large-scale earthworks and temporary material stockpiles will be introduced into views of the otherwise rural, farmed landscape and WCML. Views west, from the unnamed road between Gretna and Blacksike Bridge will be partially screened by the rise in the landform between the viewpoint and construction works. Views east will be filtered by intervening vegetation. Travelling north from the viewpoint, the construction activity will be viewed in the context of the existing WCML and will be visible across a large proportion of the view. The removal of field boundary vegetation and the loss of agricultural land will change the composition of the view compared with the baseline. Taller construction machinery for the Proposed Scheme will be visible in the background of the view, against the skyline. The combination of the above will result in a **medium** magnitude of visual change. The **medium** magnitude of visual change and **high** sensitivity will result in a **moderate** adverse significant effect.	Level of effect: **Moderate** adverse (significant)

View north-west from Nouthill Farm and Cottage (High sensitivity receptors) (VP 804-02-008)	
Residents of **high** susceptibility and with **medium** value views, will experience a substantial change to near and middle-distance views due to the presence of large-scale construction works including the construction of Annandale depot maintenance shed, accommodation building, depot sidings and B7076 realignment. Construction works will be visible across the majority of the view, with some views partially filtered through intervening vegetation. Construction activity including Annandale depot main compound, large-scale earthworks associated with the maintenance shed, accommodation building and depot sidings and temporary material stockpiles will replace views of the otherwise agricultural landscape and woodland. Construction traffic using the B7076 will introduce uncharacteristic vehicles into close views. Annandale depot main compound and temporary material stockpiles will be in the middle distance, with construction activity for the maintenance shed, accommodation building and depot sidings beyond. The emerging structures, cranes and taller construction machinery will be visible against the skyline. The undergrounding of a section of 132kV overhead power line spanning the WCML and the emerging southern sealing end pylon will also be prominent in views to the east. The removal of field boundary vegetation in the middle distance will be a noticeable change in the composition of the view. The combination of the construction works outlined across the full width of view will result in a substantial alteration to the character of the view. The combination of the above will result in a **high** magnitude of visual change. The **high** magnitude of visual change and **high** sensitivity will result in a **major** adverse significant effect.	Level of effect: **Major** adverse (significant)
Night-time effects: Residents will have near-distance views of artificial lighting at Annandale depot main compound. This will be a new area of light source within the view within a largely unlit, rural landscape. The controls on light spill set out in the draft CoCP will limit the change these new light sources introduce to the wider view. At night, there will be a **high** magnitude of visual change and a **major** adverse significant effect.	Level of effect: **Major** adverse (significant)

View north-west from Cranberry Cottage (High sensitivity receptors) (VP 803-02-005)	
Viewpoint not visited; judgments based on a precautionary approach. Residents of Cranberry Cottage and Cranville of **high** susceptibility and with **medium** value views, will experience a substantial change to near and middle-distance views due to the presence of large-scale construction works including the construction of the southern reception tracks, Cranberry Farm accommodation overbridge, Annandale depot traction sub-station, Ewes Burn realignment and the undergrounding of a 132kV overhead power line. There will be a substantial change to the rural character of existing views due to the removal of intervening field boundary vegetation and the loss of agricultural land. Construction activity including Cranberry Farm accommodation overbridge satellite compound, large-scale earthworks and temporary material stockpiles may be visible across the majority of the view. Construction traffic using the access track adjacent to the properties and another temporary access point from the B7076, will introduce uncharacteristic traffic movements into near and middle-distance views. Construction works from Annandale depot main compound, including the emerging maintenance shed, accommodation building, and depot sidings may also be visible in the middle distance of the view. The combination of the above on a precautionary basis may result in a **high** magnitude of visual change. Given the **high** magnitude of visual change and **high** sensitivity, a precautionary **major** adverse significant effect is assessed.	Level of effect: **Major** adverse (significant)
Night-time effects: Residents will have near-distance views of artificial lighting at Cranberry Farm accommodation overbridge satellite compound. Cranville residents will also have middle-distance views of artificial lighting at Annandale depot main compound. These new areas of light source will create localised areas of sky glow in a largely unlit, rural landscape. The controls on light spill set out in the draft CoCP will limit the change these new light sources introduce to the wider view. At night there may therefore be a **high** magnitude of visual change and a precautionary **major** adverse significant effect is assessed.	Level of effect: **Major** adverse (significant)

View north-west from Bensmoor Wood to Douglas Steading Core Path (High sensitivity receptors) (VP 803-03-010)	
Users of the core path of **high** susceptibility and with **medium-high** value views will experience a noticeable change to near and middle-distance views due to the presence of large-scale construction works including the construction of the southern reception tracks, the carriage washing plant and Cranberry Farm accommodation overbridge and works in association with the undergrounding of a 132kV overhead power line. Cranberry Farm accommodation overbridge satellite compound, large-scale earthworks and temporary material stockpiles will be uncharacteristic elements introduced into rural views and will be visible across the majority of the view in the middle distance. Removal of intervening field boundary vegetation will open up views of construction activity and the emerging structures. Construction traffic using Cranberry Farm access track will introduce uncharacteristic vehicle movements into views. The presence of construction activity, including Annandale depot main compound, cranes and taller construction machinery, together with the emerging maintenance shed and accommodation building will be visible below the skyline. The combination of the above will result in a **high** magnitude of visual change. The **medium** magnitude of visual change and **high** sensitivity will result in a **moderate** adverse significant effect. A photomontage illustrating this scenario is included in Volume 5: Appendix LV-001-OR003, Part 3.	Level of effect: **Moderate** adverse (significant)

View north from Redhouse Farm and Cottage (High sensitivity receptors) (VP 804-02-001)	
Residents of **high** susceptibility and with **medium** value views will experience a substantial change to near and middle-distance views due to the presence of large-scale construction works including the construction of Annandale depot maintenance shed, accommodation building, depot sidings and access underpass and the northern reception track. Some views will be filtered through intervening vegetation and screened by intervening farm buildings. Annandale depot main compound, large-scale earthworks and temporary material stockpiles will be introduced into views of the agricultural landscape, woodland and road and rail infrastructure. Construction traffic accessing the main construction area from the B7076, will introduce additional and uncharacteristic traffic movements into views. The removal of field boundary and streamside vegetation and the change in agricultural land use will be noticeable. Activities during the construction of the access road, car park, balancing ponds, together with cranes and taller construction machinery associated with the emerging maintenance shed and accommodation building will be prominent within the view with the depot sidings and the northern reception track visible beyond. The combination of the above will result in a **high** magnitude of visual change. The **high** magnitude of visual change and **high** sensitivity will result in a **major** adverse significant effect.	Level of effect: **Major** adverse (significant)
Night-time effects: Residents will have close views of artificial lighting at Annandale depot main compound. This will be a new area of light source in a largely unlit, rural landscape. The controls on light spill set out in the draft CoCP will limit the change these new light sources introduce to the wider view. At night there will therefore be a **high** magnitude of visual change and a **major** adverse effect.	Level of effect: **Major** adverse (significant)

View south-west from Cranberry Farm (High sensitivity receptors) (VP 803-02-006)	
Viewpoint not visited; judgments based on a precautionary approach. Residents of Cranberry Farm, Valley Cottage and Sarkside of **high** susceptibility and with **medium** value views will experience a substantial change to near and middle-distance views due to the presence of large-scale construction works including the construction of the southern reception tracks, Cranberry Farm accommodation overbridge, Williamsfield Farm access diversion (to the north) and the undergrounding of a section of 132kV overhead power line and construction of new sealing end pylons north and south of the WCML. Cranberry Farm accommodation overbridge satellite compound and large-scale earthworks will be introduced into views of the undulating rural landscape and WCML infrastructure. Views of construction activity south of the WCML may be partially filtered through intervening vegetation and existing railway infrastructure. There may be views of Annandale depot main compound, construction of the depot sidings and the emerging maintenance shed in the background of the view. The more elevated position of Valley Cottage and Sarkside may allow wider views across the landscape of construction activity beyond the WCML. Construction works may be visible across the majority of the view, in both near and middle-distance views. The combination of the above on a precautionary basis may result in a **high** magnitude of visual change. Given the **high** magnitude of visual change and **high** sensitivity, a precautionary **major** adverse significant effect is assessed.	Level of effect: **Major** adverse (significant)

View south-west from Cranberry Farm (High sensitivity receptors) (VP 803-02-006)	
Night-time effects: Residents will have views of artificial lighting at Cranberry Farm accommodation overbridge satellite compound in the middle distance. There may also be views of artificial lighting at Annandale depot main compound in the background of the view. These new areas of light source may create localised areas of sky glow above intervening construction works and rail infrastructure, within a largely unlit, rural landscape. The controls on light spill set out in the draft CoCP will limit the change these new light sources introduce to the wider view. At night there may therefore be a **medium** magnitude of visual change and a precautionary **moderate** adverse effect is assessed.	Level of effect: **Moderate** adverse (significant)

View north-east from The Mill Forge hotel and wedding venue (High sensitivity receptors) (VP 804-02-003), view north-east from Grahamshill Cottage (High sensitivity receptors) (VP 804-02-002)	
Residents and hotel guests of The Mill Forge hotel and wedding venue and residents at Grahamshill Cottage and East Lodge of **high** susceptibility and with **medium** value views, will experience a substantial change to near and middle-distance views due to the presence of large-scale construction works including the construction of the northern reception track and headshunt, and modifications to the WCML. Large-scale construction works and temporary material stockpiles will be introduced into views of the farmed landscape, woodland and rail infrastructure. Construction activity will be visible across a large proportion of the view. However, some views will be partially filtered through intervening vegetation and screened by intervening buildings. The removal of sections of field boundary hedgerows, trackside vegetation and sections of the narrow belt of woodland north of Grahamshill Cottage and the loss of agricultural land will change the composition of the view and will open up views of construction activity and the emerging structures. Taller elements of construction plant, traffic movements and the emerging structures of the Proposed Scheme will be seen in oblique views to the east in the middle distance and viewed against the skyline across a proportion of the view. The combination of the above will result in a **high** magnitude of visual change. The **high** magnitude of visual change and **high** sensitivity will result in a **major** adverse significant effect. A photomontage illustrating this scenario is included in Volume 5: Appendix LV-001-OR003, Part 3.	Level of effect: **Major** adverse (significant)
Night-time effects: Residents will have oblique views of artificial lighting at Annandale depot main compound. This new area of light source will create a localised area of sky glow seen in the middle distance. The controls on light spill set out in the draft CoCP will limit the change these new light sources introduce to the wider view. At night there will therefore be a **medium** magnitude of visual change and **moderate** adverse effect.	Level of effect: **Moderate** adverse (significant)

View south-east from Grahamshill Railway Cottage (High sensitivity receptors) (VP 804-02-004)	
Viewpoint not visited; judgments based on a precautionary approach. Residents of **high** susceptibility and with **medium** value views will experience a substantial change to near and middle-distance views due to the presence of large-scale construction works including the construction of the northern reception track, Annandale depot maintenance shed, accommodation buildings, depot sidings and headshunt, and modifications to the WCML. Construction activity, large-scale earthworks and temporary	Level of effect: **Major** adverse (significant)

View south-east from Grahamshill Railway Cottage (High sensitivity receptors) (VP 804-02-004)	
material stockpiles may replace views across the WCML to the farmed, rural landscape. There will be a substantial change to the character of the view. The removal of field boundary hedgerows with mature trees and small areas of woodland will open up views of construction activity and the emerging structures. There may be oblique views of Annandale depot main compound and the construction of the maintenance shed, depot sidings and accommodation building in the middle distance. The combination of the above on a precautionary basis may result in a **high** magnitude of visual change. Given the **high** magnitude of visual change and **high** sensitivity, a precautionary **major** adverse significant effect is assessed.	
Night-time effects: Lighting associated with Annandale depot main compound may create a localised area of sky glow seen in the middle distance in oblique views. The controls on light spill set out in the draft CoCP will limit the change these new light sources introduce to the wider view. At night there may be a **medium** magnitude of visual change and a precautionary **moderate** adverse effect is assessed.	Level of effect: **Moderate** adverse (significant)

View south-east from Williamsfield Farm and Cottage (High sensitivity receptors) (VP 804-02-009)	
Viewpoint not visited; judgments based on a precautionary approach. Residents of **high** susceptibility and with **medium** value views will experience a substantial change to near, middle and far-distance views due to the presence of large-scale construction works including the construction of Williamsfield Farm access diversion, the northern reception track and Annandale depot maintenance shed, accommodation building and depot sidings. The removal of intervening vegetation may open up views of construction activity and the emerging structures. However, some views may be partially filtered through intervening vegetation. Annandale depot main compound and large-scale earthworks will be introduced into views of the rural landscape, rail and road infrastructure. There will be a substantial change to the character of the view. Construction works may be visible across the majority of the view with taller construction machinery such as cranes and the emerging maintenance shed and accommodation building prominent against the skyline. The combination of the above on a precautionary basis may result in a **high** magnitude of visual change. Given a **high** magnitude of visual change and the **high** sensitivity, a precautionary **major** adverse significant effect is assessed.	Level of effect: **Major** adverse (significant)
Night-time effects: There may be views of artificial lighting at Annandale depot main compound in the middle distance. This new area of light source may create a localised area of sky glow seen above intervening construction works and the WCML. The controls on light spill set out in the draft CoCP will limit the level of change these new light sources introduce to the wider view. At night there may be a **medium** magnitude of visual change and a precautionary **moderate** adverse effect is assessed.	Level of effect: **Moderate** adverse (significant)

Other mitigation measures

6.9.57 No other mitigation measures are considered reasonably practicable during construction. Not all landscape and visual effects can be mitigated due to the visibility of construction activity and the sensitivity of surrounding receptors.

6.9.58 However, consideration will be given during the detailed design stage to where mitigation planting can be established early in the construction programme to help achieve landscape integration or visual screening at an earlier time.

Summary of likely residual significant effects

6.9.59 The temporary residual significant effects during construction remain as described above. These effects will be temporary and reversible in nature lasting only for the duration of the construction works. These residual effects will generally arise from the widespread presence of construction activity and construction plant within the landscape and viewed by surrounding residents, and users of core paths and main roads within the study area.

6.9.60 The significant effects that will remain after implementation of construction phase mitigation are summarised below:

- moderate adverse effects in relation to two LCAs;
- major adverse visual effects at eight representative residential viewpoint locations;
- major adverse night-time visual effects at three representative residential viewpoint locations;
- moderate adverse night-time visual effects at five representative residential viewpoint locations; and
- moderate adverse visual effects at two recreational viewpoint locations.

Cumulative effects

Cumulative landscape effects

6.9.61 No significant cumulative temporary effects during construction are anticipated.

Cumulative visual effects

6.9.62 No significant cumulative temporary effects during construction are anticipated.

Permanent effects arising from operation

6.9.63 The permanent features of the Proposed Scheme that have been taken into account in determining the effects arising during operation on landscape and visual receptors are presented in Section 6.1 of this report.

Avoidance and mitigation measures

6.9.64 The operational assessment of impacts and effects is based on year 1 (2038), year 15 (2053) and year 30 (2068) of the Proposed Scheme. A process of iterative design and assessment has been employed, and is ongoing, to avoid or reduce adverse effects during the operation of the Proposed Scheme. Measures that will be integrated into the design of the Proposed Scheme include:

- design of earthworks to tie the engineering earthworks for embankments and cuttings into their wider landscape context and to mitigate views of structures and overhead line equipment from sensitive receptors, where reasonably practicable. These include landscape earthworks south of the southern reception tracks, maintenance shed and accommodation building, depot sidings and headshunt. Landscape earthworks design also takes account of the relationship to surrounding land uses and management, such as agriculture;
- compensatory woodland planting in areas of loss, using the same species composition and planting types (and appropriate planting density) where reasonably practicable, such as planting on both sides of the southern reception tracks and on the northern side of the northern reception track, on the southern side of the Proposed Scheme and landscape mitigation planting located between the northern reception track and depot sidings to provide visual screening for properties to the north of the Proposed Scheme (see Volume 4, Off-route effects Map Book, Map Series CT-06-806, I5 to E5);
- hedgerow replacement and restoration in areas of loss to restore connectivity and landscape pattern, where reasonably practicable, and using an appropriate palette of hedgerow types and species to tie the Proposed Scheme mitigation into the wider landscape character; and
- compensation for loss of field ponds with new wetlands, ecological ponds and biodiversity wetland features in association with realigned sections of watercourses.

Assessment of impacts and effects

6.9.65 The likely effects on landscape and visual receptors during operation of the Proposed Scheme relate to the presence of new structures and elements in the landscape including:

- an access road for the Proposed Scheme off the B7076;
- reception tracks from the WCML leading to depot sidings and a headshunt in cutting with high permanent lighting columns in the depot platform area;
- buildings including a four-track maintenance shed, a workshop, accommodation building, stores and a car park, associated permanent lighting and a carriage washing plant and automatic vehicle inspection facility located on the southern reception tracks;
- ancillary elements including a traction sub-station, a wastewater treatment plant and balancing ponds and pumping stations;
- realignment of one section of the Ewes Burn and diversion of two lengths of unnamed tributary streams;

- undergrounding of a section of 132kV overhead power line;
- realignment of the access road to Cranberry Farm and Valley Cottage including the provision of an accommodation overbridge spanning the southern reception tracks:
- diversion of the access road to Williamsfield Farm and Cottage and removal of the Williamsfield Farm accommodation underbridge beneath the WCML; and
- local widening of the B7076.

6.9.66 Non-significant effects are reported in Volume 5: Appendix LV-001-OR003.

Landscape assessment

6.9.67 The LCA described in Table 33 will be significantly affected during operation of the Proposed Scheme.

Table 33: Operational phase significant landscape effects

Location	
River Sark Flats LCA	
Year 1: The southern section of this LCA will be directly affected by the introduction and operation of the Proposed Scheme between the WCML and the B7076. The wider setting of this LCA will also be indirectly affected by the Proposed Scheme including Annandale depot in the adjacent Southern Flow Plateau LCA. Modifications to the WCML, a pumping station and associated storage tanks, the southern reception tracks and Cranberry Farm accommodation overbridge will introduce new large-scale elements into the rural landscape. The change to land use, across part of the LCA, will be noticeable. The loss of some agricultural land and associated hedgerows, individual mature trees and small areas of woodland, during construction will affect both the landscape pattern and scenic quality. Tranquillity will be further reduced in the vicinity of the new railway infrastructure which will be at a larger scale than the existing WCML. However, the southern reception tracks will be in cutting and partially integrated into the LCA by landscape earthworks. Newly planted mitigation planting will not be sufficiently mature to provide any landscape integration. Train movements will be seen in the context of existing train movements along the WCML. There will be indirect effects as a result of lighting in the vicinity of Annandale depot which will result in a noticeable change to the landscape character within a part of the LCA. With the moderate levels of tranquillity associated with the agricultural and river valley landscape, relative remoteness with the presence of some detracting features, the landscape has a **medium** susceptibility to change arising from the Proposed Scheme. The **medium** magnitude of change for the River Sark Flats and its **medium** sensitivity will result in a **moderate** adverse significant effect.	Level of effect: **Moderate** adverse (significant)
Year 15 and Year 30: Effects will reduce to non-significant in year 15 and remain so for year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: Non-significant
Southern Flow Plateau LCA	
Year 1: The southern part of this LCA will be directly affected by the presence of Annandale depot including the depot sidings, maintenance shed and accommodation building, depot sidings underpass, northern reception track, B7076 realignment, modifications to WCML and Williamsfield Farm access diversion. Although set within the context of the WCML, the B7076 and the A74(M) transport corridors, the Proposed Scheme will introduce uncharacteristic	Level of effect: **Moderate** adverse (significant)

Location	
changes to landscape character and scale across a small proportion of this LCA. The pattern of agricultural land in proximity to the Proposed Scheme, including hedgerows, individual mature trees and linear woodland lost during construction, will be replaced by large-scale infrastructure elements altering land use and the landscape context. The presence of the Proposed Scheme will affect the landscape setting of Grahamshill Farmhouse and Steading (the Mill Forge hotel and wedding venue) Grade B listed building. Short sections of Ewes Burn will have been realigned during construction with the loss of scattered vegetation apparent. The extent of local open access land, granted under the Land Reform (Scotland) Act 2003, will be reduced within the area of Annandale depot. The Proposed Scheme will be partially integrated into its landscape setting by landscape earthworks. However, newly planted mitigation planting will not be sufficiently mature to provide any landscape integration of the Proposed Scheme in year 1. The lighting associated with Annandale depot will result in a noticeable change to the landscape character within a part of the LCA. The presence of additional railway infrastructure at a greater scale than the existing WCML and train movements will further reduce levels of low tranquillity in the south of the LCA. The presence of the Proposed Scheme will result in a noticeable change to the landscape character within a proportion of the LCA. With the open character of the landscape and perception of relative tranquillity and remoteness to the north of the LCA and the presence of some detracting features in the south of the LCA, the landscape has a **medium** susceptibility to change arising from the Proposed Scheme. The **medium** magnitude of change for the Southern Flow Plateau and its **medium** sensitivity will result in a **moderate** adverse significant effect.	
Year 15: The landscape mitigation planting in association with landscape earthworks will be sufficiently established to assist with integration of the Proposed Scheme into the LCA. The Proposed Scheme will remain a new large-scale element, resulting in a noticeable change to landscape character, despite its context within the WCML, the B7076 and the A74(M) transport corridors. The magnitude of change will remain as **medium** with a **moderate** adverse significant effect.	Level of effect: **Moderate** adverse (significant)
Year 30: Greater maturity of the mitigation planting will integrate the Proposed Scheme into the landscape and effects will be non-significant (reported in detail in Volume 5).	Level of effect: Non-significant

Visual assessment

Introduction

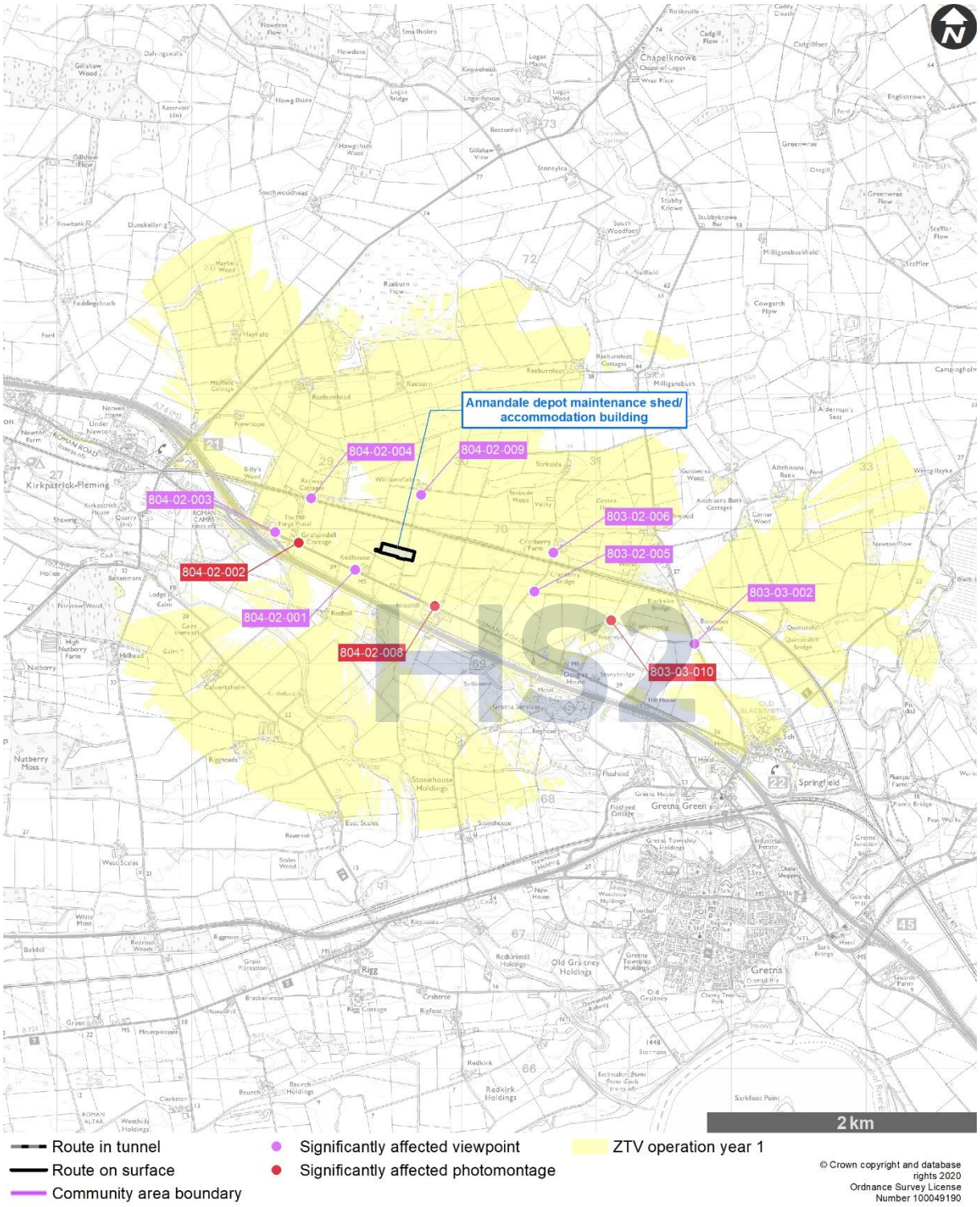
6.9.68 The following section describes the likely significant effects on visual receptors during operation in the winter and summer of year 1 and in the summer of both year 15 and year 30. The year 1 assessment includes the winter period, in line with best practice guidance, to ensure a robust assessment. In some cases, visibility of the operational Proposed Scheme may be reduced during summer when vegetation, if present in a view, will be in leaf. Where visual receptors are predicted to experience significant effects at night-time arising from additional lighting, these are also presented in this section.

6.9.69 Where a viewpoint represents multiple types of receptor, the assessment is based on the most sensitive receptor. Effects on other receptor types with a lower sensitivity will be lower than those reported.

6.9.70 The assessment has identified locations where additional lighting during operation will result in significant effects on visual receptors (summarised in Table 34 and described in detail in Volume 5: Appendix LV-001-OR003, Part 3).

6.9.71 Table 34 identifies the locations where the operation of the Proposed Scheme will potentially result in significant effects. Viewpoint locations are shown in Map Series LV-04 in the Volume 4, ADEP Landscape and visual Map Book.

Table 34: Operation phase significant visual effects



View north-west from Quintinshill and the River Sark circular walk (High sensitivity receptors) (VP 803-03-002)	
Year 1 – winter and summer: Users of the promoted recreational route of **high** susceptibility and with **medium-high** value views will experience a noticeable change to the rural character of middle-distance views. The southern reception tracks, pumping station and storage tank, Cranberry Farm accommodation overbridge and modifications to the WCML will be new and uncharacteristic elements introduced into views of the wider agricultural landscape and WCML. Views to the west will be partially screened by the rise in the landform between the viewpoint and Proposed Scheme. Views east will be filtered through intervening vegetation. Travelling north from the viewpoint, the Proposed Scheme will be viewed in the context of the existing WCML and will be visible across a proportion of the view. The southern reception tracks will be in cutting and partially screened by landscape mitigation earthworks. However, upper elements of the overhead line equipment and train movements will be partially visible above the line of mitigation earthworks. Cranberry Farm accommodation overbridge will be a new raised element within the view. Mitigation planting will not be sufficiently established to assist in the filtering of views or the visual integration of the Proposed Scheme into views. The combination of the above will result in a **medium** magnitude of visual change. The **medium** magnitude of visual change and **high** sensitivity will result in a **moderate** adverse significant effect.	Level of effect: **Moderate** adverse (significant)
Years 15 and Year 30 – summer: Effects will reduce to non-significant by year 15 and beyond to year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)

View north-west from Nouthill Farm and Cottage (High sensitivity receptors) (VP 804-02-008)	
Year 1 – winter and summer: Residents of **high** susceptibility with **medium** value views will experience a substantial change to middle-distance views seen over intervening road and trackside hedgerows and agricultural land. Annandale depot, including the maintenance shed, accommodation building and depot sidings will be new large-scale elements that will partially replace views of the otherwise agricultural landscape and woodland. The Proposed Scheme will be visible across a large proportion of the view. The Proposed Scheme will be at a much greater scale than the existing WCML and will substantially change the predominantly rural character of the view. Middle and far-distance views to the north and west will be foreshortened by the presence of the train maintenance shed and accommodation building. Landscape earthworks will partially screen views of the lower sections of the accommodation building and maintenance shed, beyond which a wide extent of the depot sidings and the upper elements of overhead line equipment and train movements will be visible. Far-distance views of the rural landscape to the north will be visible over the Proposed Scheme. Newly planted mitigation planting will not be sufficiently established to assist in the filtering of views or the visual integration of the Proposed Scheme into views. The combination of the above will result in a **high** magnitude of visual change. The **high** magnitude of visual change and **high** sensitivity will result in a **major** adverse significant effect. A photomontage illustrating this scenario is included Volume 5: Appendix LV-001-0R003, Part 3	Level of effect: **Major** adverse (significant)
Year 15 – summer: Maturing mitigation planting in association with landscape earthworks will partially filter and screen views of the lower elements of the Proposed Scheme. The upper extents of Annandale depot including the maintenance shed, accommodation building and overhead line equipment will remain visible in middle-distance views, partially filtered through intervening vegetation. Views will be in the context of the existing WCML and the B7076 road corridor.	Level of effect: **Moderate** adverse (significant)

View north-west from Nouthill Farm and Cottage (High sensitivity receptors) (VP 804-02-008)	
The magnitude of visual change will reduce to **medium** resulting in a **moderate** adverse significant effect. A photomontage illustrating this scenario is included Volume 5: Appendix LV-001-0R003, Part 3	
Year 30 – summer: Effects will reduce to non-significant by year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)
Year 1 – night-time Residents will have middle-distance views of operational lighting at Annandale depot including lighting to the depot sidings area and pedestrian paths between work areas. This new area of light source will be uncharacteristic within this largely unlit, rural landscape. The lights will be designed to reduce the visual impact of the lighting installation. At night, there will be a **medium** magnitude of visual change and a **moderate** adverse significant effect.	Level of effect: **Moderate** adverse (significant)
Year 15 and Year 30 – night-time: The magnitude of visual change will be reduced to non-significant by year 15 and remain so for year 30 due to the growth and maturity of the landscape mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)

View north-west from Cranberry Cottage (High sensitivity receptors) (VP 803-02-005)	
Year 1 – winter and summer: Viewpoint not visited; judgments based on a precautionary approach. Residents of Cranberry Cottage and Cranville of **high** susceptibility with **medium** value views will experience a substantial change to near and middle-distance views. The southern reception tracks, Cranberry Farm accommodation overbridge, Annandale depot traction sub-station and the southern new sealing end pylon will be new infrastructure elements introduced into views of the farmed landscape and WCML. These new elements will be at a greater scale than existing rail infrastructure and may be seen across a large proportion of the view, although partially screened by landscape earthworks. Overhead line equipment and the upper elements of train movements may be visible above the landscape earthworks and seen in the context of overhead line equipment on the WCML. The eastern elevation of the maintenance shed and accommodation building may be visible to the west, partially screened by landscape earthworks. Newly planted mitigation planting will not be sufficiently established to assist in the filtering of views or the visual integration of the Proposed Scheme into views. The combination of the above on a precautionary basis may result in a **high** magnitude of visual change. Given the **high** magnitude of visual change and **high** sensitivity, a precautionary **major** adverse significant effect is assessed.	Level of effect: **Major** adverse (significant)
Year 15 – summer: Maturing mitigation planting in association with landscape earthworks and mitigation hedgerows along field boundaries, may partially filter and screen views of the lower elements of the Proposed Scheme. The upper extents of Cranberry Farm accommodation overbridge, the southern new sealing end pylon, train movements and overhead line equipment along the southern reception tracks and northern reception track may remain visible in the middle-distance, partially filtered through intervening vegetation. Mitigation planting may also filter views of WCML and the eastern elevation of the maintenance shed and accommodation building to the west. However, maturing mitigation planting may also foreshorten views across the farmed landscape to woodland and may form the new skyline. The magnitude of visual change may reduce to be **medium**, and a precautionary **moderate** adverse significant effect is assessed.	Level of effect: **Moderate** adverse (significant)

View north-west from Cranberry Cottage (High sensitivity receptors) (VP 803-02-005)	
Year 30 – summer: Effects may reduce to non-significant by year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)
Year 1 – night-time: Residents may have middle-distance views of operational lighting at Annandale depot including lighting to the depot sidings and pedestrian paths between work areas. This new area of light source may create a localised area of sky glow above intervening landscape earthworks within a largely unlit, rural landscape. The lights will be designed to reduce the visual impact of the lighting installation. At night, there may be a **medium** magnitude of visual change and a precautionary **moderate** adverse significant effect is assessed.	Level of effect: **Moderate** adverse (significant)
Year 15 and Year 30 – night-time Effects may reduce to non-significant by year 15 and will remain so for year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)

View north-west from Bensmoor Wood to Douglas Steading Core Path (High sensitivity receptors) (VP 803-03-010)	
Year 1 – winter and summer: Users of the core path of **high** susceptibility and with **medium-high** value views will experience a noticeable change to middle-distance views. The Proposed Scheme including the southern reception tracks, the carriage washing plant, a pumping station and storage tank and Cranberry Farm accommodation overbridge, will be new and uncharacteristic elements in views south of the WCML within a predominantly rural landscape. In the near distance, the eastern extent of the southern reception tracks in shallow cutting will be largely screened by landscape earthworks, as will Annandale depot traction sub-station and the carriage washing plant, west of Cranberry Farm access track. The upper elements of the overhead line equipment and train movements along the southern reception tracks will be partially visible above the line of the earthworks. Cranberry Farm accommodation overbridge will be a new raised element within the view, more noticeable than the WCML accommodation bridge due to height and length. There will be views along the length of Annandale depot including the maintenance shed, accommodation building and overhead line equipment along the southern reception tracks and in depot sidings. The extent and scale of these structures will be uncharacteristic elements introduced into views of the wider agricultural setting. The two sealing end pylons will be visible following the undergrounding of a 132kV overhead power line but will be seen in the context of existing pylons. Mitigation planting will not be sufficiently established to assist in the filtering of views or the visual integration of the Proposed Scheme into views. The combination of the above will result in a **medium** magnitude of visual change. The **medium** magnitude of visual change and **high** sensitivity will result in a **moderate** adverse significant effect. A photomontage illustrating this scenario is included Volume 5: Appendix LV-001-0R003, Part 3	Level of effect: **Moderate** adverse (significant)
Years 15 and Year 30 – summer: Effects will reduce to non-significant by year 15 and beyond to year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect (non-significant)

View north from Redhouse Farm and Cottage (High sensitivity receptors) (VP 804-02-001)	
Year 1 – winter and summer: Residents of **high** susceptibility and with **medium** value views will experience a substantial change to the rural character of near and middle-distance views. Annandale depot will introduce new and	Level of effect: **Major**

View north from Redhouse Farm and Cottage (High sensitivity receptors) (VP 804-02-001)	
large-scale structures into views of the agricultural landscape, woodland and road and rail infrastructure. The Proposed Scheme will be at a far greater scale and closer in the view than the WCML and will be visible across the majority of the view. However, some views will be filtered through intervening vegetation and screened by intervening farm buildings and landscape earthworks. The access road off the realigned B7076 will be seen in the near distance, with views of the upper elements of Annandale depot accommodation building and maintenance shed visible beyond. The maintenance shed will form the new skyline across a large proportion of the view. The proximity and height of the maintenance shed and landscape earthworks will foreshorten some views northwards, screening views of higher rural land beyond the WCML. Train movements and overhead line equipment at the depot sidings and the northern reception track will be visible in the middle distance and seen in the context of the WCML. Mitigation planting will not be sufficiently established to assist in filtering views or visual integration of the Proposed Scheme into views. The combination of the above will result in a **high** magnitude of visual change. The **high** magnitude of visual change and **high** sensitivity will result in a **major** adverse significant effect.	adverse (significant)
Year 15 – summer: Maturing mitigation planting in association with landscape earthworks and along Annandale depot access road off the realigned B7076, will partially filter views of the lower extents of the maintenance shed, accommodation building and depot sidings in the near distance. However, the upper extents of the main elevation of the maintenance shed and accommodation building will remain prominent within the view, seen against the skyline. East and west of the maintenance shed, some upper elements of train movements and overhead line equipment in the depot sidings will also be visible. Although mitigation planting will help to integrate the Proposed Scheme, a substantial alteration to the characteristics of the view will remain. The magnitude of visual change will remain **high** and effects will continue to be **major** adverse significant.	Level of effect: **Major** adverse (significant)
Year 30 – summer: The greater maturity of mitigation planting will provide denser screening in summer months reducing the visibility of overhead line equipment and train movements. However, some visibility of the upper elements of the maintenance shed will remain. The magnitude of visual change will reduce to **medium** and effects will be **moderate** adverse significant.	Level of effect: **Moderate** adverse (significant)
Year 1 – night-time: Residents will have views of operational lighting at Annandale depot including lighting to the depot sidings area and pedestrian paths between work areas, seen beyond and to either side of the maintenance shed. This new area of light source will create a localised area of sky glow seen above intervening landscape earthworks and within a largely unlit, rural landscape. The lights will be designed to reduce the visual impact of the lighting installation. At night there will therefore be a **medium** magnitude of visual change and a **moderate** adverse effect.	Level of effect: **Moderate** adverse (significant)
Years 15 and 30 – night-time: Effects will reduce to non-significant by year 15 and will remain so for year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)

View south-west from Cranberry Farm (High sensitivity receptors) (VP 803-02-006)	
Year 1 – winter and summer: Viewpoint not visited; judgments based on a precautionary approach. Residents of Cranberry Farm, Valley Cottage and Sarkside of **high** susceptibility and with **medium** value views will experience a substantial change to the rural character of near and middle-distance views. The southern reception tracks, Cranberry Farm access accommodation overbridge, the northern sealing end pylon, Annandale depot traction sub-station and the northern reception	Level of effect: **Major** adverse (significant)

View south-west from Cranberry Farm (High sensitivity receptors) (VP 803-02-006)	
track will be new large-scale infrastructure elements introduced into views of the farmed landscape and WCML infrastructure. The southern reception tracks will be partially screened in cutting. Cranberry Farm accommodation overbridge will be a new raised element in the view. The Proposed Scheme will be at a much larger scale than existing rail infrastructure and may be visible across the majority of the view, beyond the WCML. Views may be partially filtered through intervening vegetation and screened by existing rail infrastructure. Train movements and overhead line equipment along the southern reception tracks and the northern reception track will be seen in the context of WCML. There may be views further to the south-west to the eastern elevation of the maintenance shed and accommodation building. The more elevated positions of Valley Cottage and Sarkside may allow wider views south of the WCML, across the depot to the wider landscape beyond. Mitigation planting will not be sufficiently established to assist in the filtering of views or the visual integration of the Proposed Scheme into views. The combination of the above on a precautionary basis may result in a **high** magnitude of visual change. Given the **high** magnitude of visual change and **high** sensitivity, a precautionary **major** adverse significant effect is assessed.	
Year 15 – summer: Maturing mitigation planting on land between the WCML and the northern and southern reception tracks and on Cranberry Farm accommodation overbridge embankments, may partially filter views of the Proposed Scheme. However, the upper elements of Cranberry Farm accommodation overbridge, Annandale depot traction sub-station, overhead line equipment and train movements may remain visible in the middle distance, above the line of mitigation planting. Further west, the upper elements of the maintenance shed, accommodation building and overhead line equipment within the depot sidings may also be visible above intervening and maturing mitigation planting. All views will be in the context of the WCML in the near distance of the view. The magnitude of visual change may reduce to **medium** and a precautionary **moderate** adverse significant effect is assessed.	Level of effect: **Moderate** adverse (significant)
Year 30 – summer: Effects may reduce to non-significant by year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)
Year 1 – night-time: Residents may have middle-distance views of operational lighting at Annandale depot including lighting to the depot sidings area and pedestrian paths between work areas. This new area of light source will create a localised area of sky glow seen above intervening WCML rail infrastructure and within a largely unlit, rural landscape. The lights will be designed to reduce the visual impact of the lighting installation. At night, there may be a **medium** magnitude of visual change and a precautionary **moderate** adverse significant effect is assessed.	Level of effect: **Moderate** adverse (significant)
Year 15 and Year 30 – night-time Effects may reduce to non-significant by year 15 and will remain so for year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)

View north-east from The Mill Forge hotel and wedding venue (High sensitivity receptors) (VP 804-02-003), north-east from Grahamshill Cottage (High sensitivity receptors) (VP 804-02-002)	
Year 1 – winter and summer: Residents and hotel guests of The Mill Forge hotel and wedding venue and residents at Grahamshill Cottage and East Lodge of **high** susceptibility and with **medium** value views will experience a substantial change to middle-distance views. The Annandale depot maintenance shed, accommodation building and depot sidings, the headshunt, and associated landscape	Level of effect: **Major** adverse (significant)

View north-east from The Mill Forge hotel and wedding venue (High sensitivity receptors) (VP 804-02-003), north-east from Grahamshill Cottage (High sensitivity receptors) (VP 804-02-002)	
earthworks, will be new large-scale elements introduced into views of the agricultural landscape and the WCML. Some views will be partially filtered through intervening vegetation and screened by intervening buildings, but vegetation removed during construction, will allow open views north from Grahamshill Cottage. The headshunt will be in cutting and the northern reception track will run parallel to the WCML. Although views will be in the context of the WCML, the Proposed Scheme will be at a much larger scale than existing rail infrastructure. Landscape earthworks south and west of the headshunt cutting and balancing pond will screen the headshunt and lower sections of the depot sidings, although taller elements including the maintenance shed, accommodation building, overhead line equipment and train movements will be visible above the line of the earthworks. The maintenance shed and accommodation building will be new and uncharacteristic buildings, prominent within the view and will create the new skyline across a small proportion of the view. Mitigation planting will not be sufficiently established to assist in the filtering of views or the visual integration of the Proposed Scheme into views. The combination of the above will result in a **high** magnitude of visual change. The **high** magnitude of visual change and **high** sensitivity will result in a **major** adverse significant effect. A photomontage illustrating this scenario is included in Volume 5: Appendix LV-001-OR003, Part 3.	
Year 15 – summer: Maturing mitigation planting in association with landscape earthworks and new hedgerow planting will partially filter views of lower elements of the Proposed Scheme. However, taller elements including the upper elevation of Annandale depot maintenance shed will be noticeable in the middle distance, above the landscape mitigation planting and visible against the skyline. Near-distance views over agricultural land south of the WCML will include replacement field boundary hedgerows filtering views of landscape earthworks south of the headshunt. Woodland planting between the headshunt and the northern reception track will largely screen views further north, beyond the WCML. Woodland planting on the landscape earthworks south and west of the depot building and south of the northern reception track will foreshorten views to the north and east. A noticeable alteration in the character of views resulting from the Proposed Scheme will remain, although partially screened by intervening vegetation. The magnitude of visual change will reduce to **medium** resulting in a **moderate** adverse significant effect.	Level of effect: **Moderate** adverse (significant)
Year 30 – summer: Effects will reduce to non-significant by year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)
Year 1 – night-time: Operational lighting associated with Annandale depot will create a localised area of sky glow seen above intervening vegetation and within a largely unlit, rural landscape. The lights will be designed to reduce the visual impact of the lighting installation. At night, there will be a **medium** magnitude of visual change and a **moderate** adverse significant effect.	Level of effect: **Moderate** adverse (significant)
Year 15 and Year 30 – night-time: Effects will reduce to non-significant by year 15 and will remain so for year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (non-significant)

View south-east from Grahamshill Railway Cottage (High sensitivity receptors) (VP 804-02-004)	
Year 1 – winter and summer: Viewpoint not visited; judgments based on a precautionary approach.	Level of effect:

View south-east from Grahamshill Railway Cottage (High sensitivity receptors) (VP 804-02-004)	
Residents of **high** susceptibility and with **medium** value views will experience a substantial change to near and middle-distance views. The northern reception track, headshunt and modifications to the WCML, will be new large-scale infrastructure elements introduced into close views of the WCML and rural farmed landscape. The Proposed Scheme will be at a much greater scale than existing rail infrastructure and may be visible across the entire view. The northern reception track will run parallel to the WCML and the headshunt will be in cutting. There may be views of the upper elements of the Proposed Scheme including overhead line equipment and train movements, but these will be seen in the context of the WCML. Annandale depot maintenance shed, accommodation building, and depot sidings may be visible in the middle distance in oblique views to the east and may form the skyline across a proportion of the view. Mitigation planting will not be sufficiently established to assist in the filtering of views or the visual integration of the Proposed Scheme into views. The combination of the above on a precautionary basis may result in a **high** magnitude of visual change. Given the **high** magnitude of visual change and **high** sensitivity, a precautionary **major** adverse significant effect is assessed.	**Major** adverse (significant)
Year 15 and Year 30 – summer: Effects may reduce to non-significant in year 15 and remain so for year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: Non-significant
Year 1 – night-time Residents may have middle-distance views of operational lighting at Annandale depot including lighting to the depot sidings area and pedestrian paths between work areas. This new area of light source may create a localised area of sky glow above intervening landscape earthworks within a predominantly unlit, rural landscape. The lights will be designed to reduce the visual impact of the lighting installation. At night, there may be a **medium** magnitude of visual change and a precautionary **moderate** adverse significant effect is assessed.	Level of effect: **Moderate** adverse (significant)
Year 15 and Year 30 – night-time: Effects may reduce to non-significant in year 15 and remain so for year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: Non-significant

View south-east from Williamsfield Farm and Cottage (High sensitivity receptors) (VP 804-02-009)	
Year 1 – winter and summer: Viewpoint not visited; judgments based on a precautionary approach. Residents of **high** susceptibility and with **medium** value views will experience a substantial change to near and middle-distance views. Williamsfield Farm access diversion track will be visible in the near distance to the north of the WCML. The northern reception track, and Annandale depot including the maintenance shed, accommodation building, and depot sidings may be visible across the majority of the view to the south of the WCML. Overhead line equipment and train movements may be seen in the context of the WCML. However, the Proposed Scheme will be at a much greater scale than existing rail infrastructure and may substantially alter the character of rural views. The maintenance shed and accommodation buildings may create the new skyline across a small proportion of the view. Mitigation planting will not be sufficiently established to assist in the filtering of views or the visual integration of the Proposed Scheme into views. The combination of the above on a precautionary basis may result in a **high** magnitude of visual change. Given the **high** magnitude of visual change and **high** sensitivity, a precautionary **major** adverse significant effect is assessed.	Level of effect: **Major** adverse (significant)

View south-east from Williamsfield Farm and Cottage (High sensitivity receptors) (VP 804-02-009)	
Year 15 – summer: Maturing mitigation planting along the diverted Williamsfield Farm access and in a woodland belt west of the access track may partially filter views of vehicle movements along this track and of train movements along the WCML. Mitigation planting between the WCML, the northern reception track and depot sidings, may partially filter views of the Proposed Scheme south of the WCML. However, the taller elements of Annandale depot including the maintenance shed and accommodation building, may remain visible above the line of mitigation planting in the middle distance, and may continue to form the skyline across a proportion of the view. The magnitude of visual change will reduce to **medium** and a precautionary **moderate** adverse significant effect is assessed.	Level of effect: **Moderate** adverse (significant
Year 30 – summer: The greater maturity of the mitigation planting may further filter views of the Proposed Scheme. The upper extents of the maintenance shed and accommodation building may continue to form the skyline across a small proportion of the view. However, the growth of the mitigation planting may limit the availability of former long-distance views towards the Solway Firth. The magnitude of visual change may remain **medium** and a precautionary **moderate** adverse significant effect is assessed.	Level of effect: **Moderate** adverse (significant)
Year 1 – night-time: Residents may have views of operational lighting associated with Annandale depot, most notably the depot sidings. This new area of light source may create a localised area of sky glow, which may be visible across the majority of the view in the middle distance within a largely unlit, rural landscape. The lights will be designed to reduce the visual impact of the lighting installation. At night there may be a **medium** magnitude of visual change and a precautionary **moderate** adverse effect is assessed	Level of effect: **Moderate** adverse (significant)
Year 15 and Year 30 – night-time: Effects may reduce to non-significant in year 15 and remain so for year 30 due to the growth and maturity of the mitigation planting (reported in detail in Volume 5).	Level of effect: (Non-significant

Other mitigation measures

6.9.72 The permanent effects of the Proposed Scheme on landscape and visual receptors have been reduced through integration in the design of the measures described in this section. Effects in year 1 may also be further reduced through establishing planting early or in advance of the main construction programme.

Summary of likely residual significant effects

6.9.73 In many cases, significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. However, the following likely residual significant effects will remain at year 15 of operation:

- moderate adverse effects in relation to one LCA;
- major adverse visual effects at one representative residential viewpoint location; and
- moderate adverse visual effects at six representative residential viewpoint locations.

Cumulative effects

Cumulative landscape effects

6.9.74 No significant cumulative temporary effects during operation are anticipated.

Cumulative visual effects

6.9.75 No significant cumulative temporary effects during operation are anticipated.

Monitoring

6.9.76 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.9.77 There are no area-specific requirements for monitoring landscape and visual mitigation during the operation of the Proposed Scheme in the Annandale area.

6.10 Socio-economics

Introduction

6.10.1 This section reports on the environmental baseline, likely economic and employment impacts, as well as significant effects during construction and operation of the Proposed Scheme within the Annandale area. The assessment considers existing businesses, community organisations, local employment and local economies, including planned growth and development.

6.10.2 The socio-economic effects on employment at a route-wide level are reported in Volume 3, Route-wide effects, Section 12. Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. The Proposed Scheme is described in Section 6.1.

Scope, assumptions and limitations

6.10.3 The scope, assumptions and limitations for the socio-economics assessment are set out in Volume 1, Introduction and methodology, Section 8 and the Environmental Impact Assessment Scope and Methodology Report[183]. The assessment of in-combination effects draws on the findings of other technical disciplines (e.g. air quality, sound, noise and vibration, landscape and visual, and traffic and transport).

[183] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report.*

Environmental baseline

Existing baseline

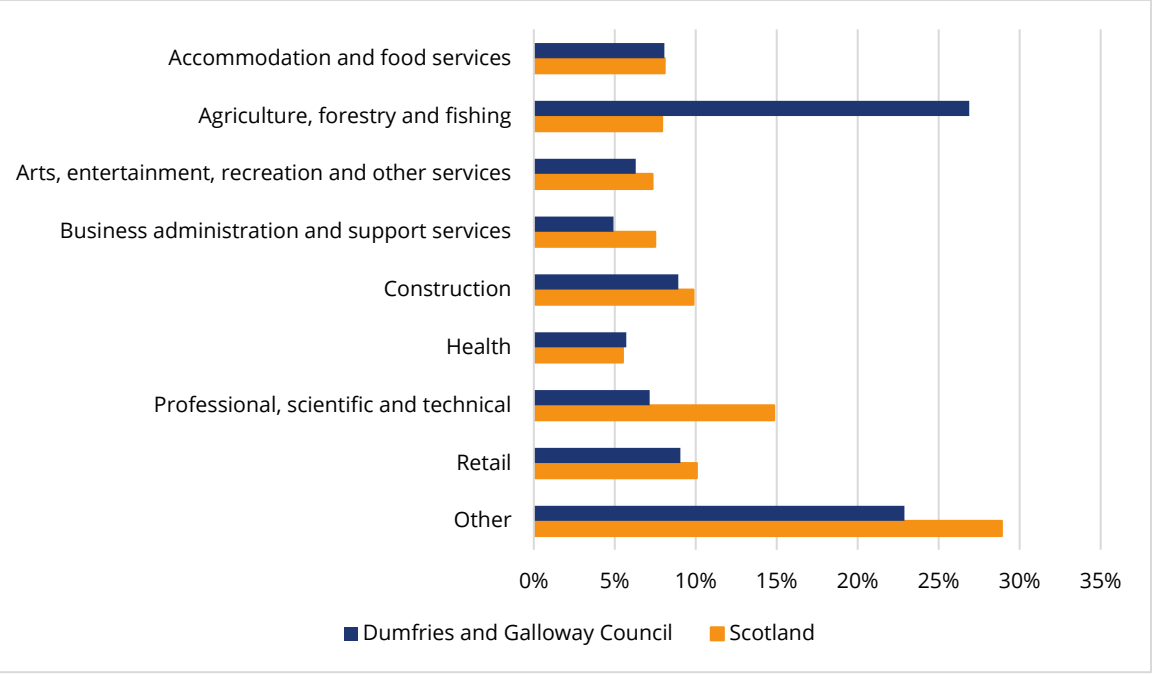
Study area description

6.10.4 The following provides a brief overview of employment, economic structure, labour market and business premises availability within the Annandale area which lies within the administrative area of Dumfries and Galloway Council (DGC) in Scotland.

Business and labour market

6.10.5 Within the DGC administrative area, there is a wide spread of business types reflecting a diverse range of commercial activities. In 2020, the agriculture, forestry and fishing sector accounted for the largest proportion of businesses (27%), with retail the second largest (9%), followed by construction (9%) and accommodation and food services (8%), as shown in Figure 17. For comparison with Scotland, the largest sectors were professional, scientific and technical (15%) and retail (10%), followed by construction (10%) and accommodation and food services (8%)[184].

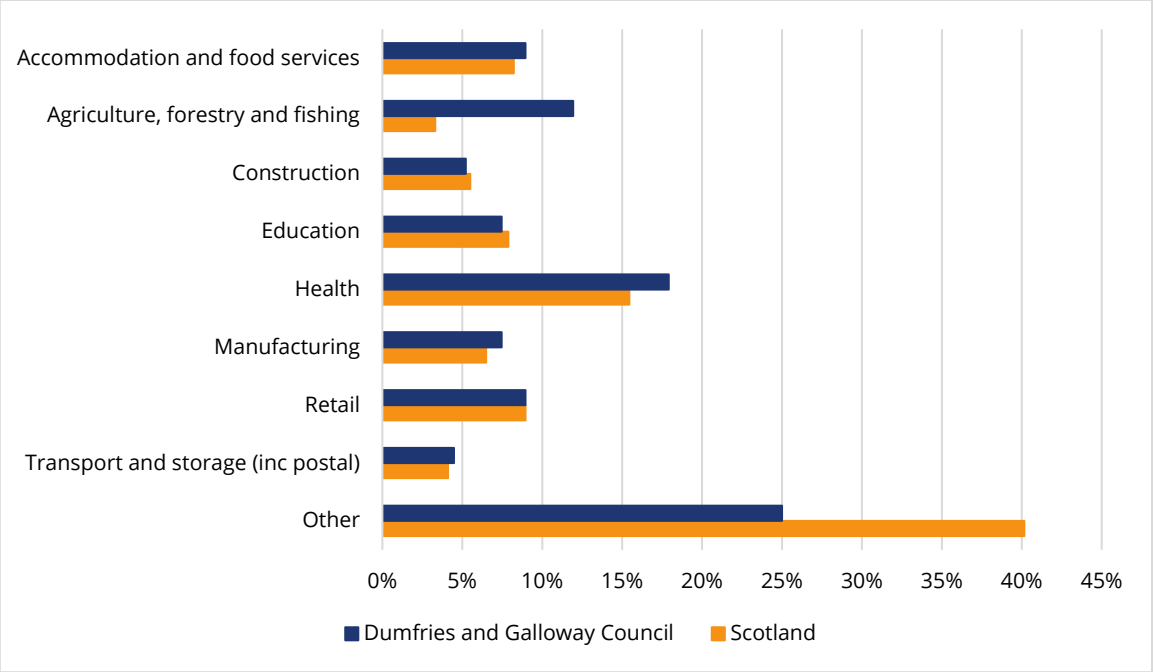
Figure 18: Business sector composition in the Dumfries and Galloway Council area and Scotland



[184] Office for National Statistics (2020), *UK Business Counts – local units by industry and employment size band* 2020. Available online at: http://www.nomisweb.co.uk/datasets/idbrlu.

6.10.6 In 2019[185], approximately 67,000 people worked in the DGC area. According to the Office for National Statistics Business Register and Employment Survey 2019, the top four sectors in terms of share of employment were: health (18%); agriculture, forestry and fishing (12%); retail (9%); and accommodation and food services (9%). These compare with the top four sectors for Scotland, which were: health (15%); retail (9%); accommodation and food services (8%); and education (8%), as shown in Figure 18.

Figure 19: Employment by industrial sector in the Dumfries and Galloway Council area and Scotland



6.10.7 According to the Annual Population Survey (2020)[186], the employment rate[187] within the DGC area was 68% (57,800 people), which is lower than that recorded for Scotland (74%). In 2020, unemployment in the DGC area was 6.1%, which was higher than that recorded for Scotland (4.4%).

6.10.8 The Annual Population Survey (2020)[19] also shows that 37% of DGC residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, which was lower than that recorded for Scotland (49%), while 8.9% of residents had no qualifications, which was higher than that recorded for Scotland (8%).

[185] Office for National Statistics (2019), *Business Register and Employment Survey: open access 2019*. Available online at: http://www.nomisweb.co.uk/datasets/newbres6pub. This number includes both residents and non-residents of DGC who work within its boundaries.

[186] Office for National Statistics (2020), *Annual Population Survey*. Available online at: http://www.nomisweb.co.uk/datasets/apsnew. This number includes the jobs held by residents of DGC irrespective of where they work.

[187] The proportion of working age (16 – 64 year olds) residents that are in employment.

Property

6.10.9 A review of employment land in 2020 identified there was a supply of 255ha of employment land available across Dumfries and Galloway, though much of this supply was constrained[188]. In October 2019, DGC adopted the Local Development Plan 2 which identified an employment land requirement of 112ha over a 20-year period (2017-2037)[189]. Sites have been identified within the Gretna-Lockerbie-Annan regeneration corridor, linked by the A74(M).

6.10.10 The average vacancy rate for industrial and warehousing property in the DGC area has been assessed as 23%, which is high, based on marketed space against known stock[190].

6.10.11 Based upon the latest available data from the Estates Gazette (October 2019) and Costar (2017) the average vacancy rate for office space in the DGC area is 17%[191].

Future baseline

Construction (2025)

6.10.12 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2025. No committed developments of relevance for socio-economics have been identified that would materially alter the future baseline in this area.

Operation (2038)

6.10.13 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2038. No committed developments of relevance for socio-economics have been identified that would materially alter the future baseline in this area.

Effects arising during construction

Avoidance and mitigation measures

6.10.14 The draft Code of Construction Practice (CoCP)[192] includes a range of provisions that will help mitigate socio-economic effects associated with construction within this area, including:

[188] Dumfries and Galloway Council (2021), *Dumfries & Galloway* Business and Industry Land Audit 2020.

[189] Dumfries and Galloway Council (2019), *Local Development Plan (LDP2).* Available online at: https://www.dumgal.gov.uk/ldp2.

[190] Vacant space is based on marketed space identified from Estates Gazette data; stock data are based on Costar evidence taken from the Ryden (2017), *Employment Land and Property Technical Paper*, as reported to DGC.

[191] Based on marketed space identified from Estates Gazette data (October 2019) and Costar (2017).

[192] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP).*

- reducing nuisance through the sensitive layout of construction sites (Section 5);
- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (Section 12);
- applying best practicable means during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses) (Section 13);
- monitoring and managing flood risk and other extreme weather events that may affect socio-economic resources during construction (Section 16);
- site-specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (Section 14); and
- maintaining access to businesses for the duration of construction works where reasonably practicable (Section 14).

Assessment of impacts and effects

Temporary effects

In-combination effects

6.10.15 Businesses within the Annandale area may experience a number of effects as a result of the construction of the Proposed Scheme, for example, air quality, landscape and visual, noise and vibration or construction traffic impacts. Taken in-combination, these multiple residual effects could amount to a significant change in the ambience at these businesses leading to a possible loss of trade for one business – the Mill Forge hotel and wedding venue. Durations of in-combination effects have been identified in this section where information on the duration of contributing effects is provided in the relevant source assessments. The assessment of in-combination effects draws upon the air quality, landscape and visual, sound, noise and vibration, and traffic and transport assessments reported in this section.

6.10.16 The Mill Forge hotel and wedding venue, located in Kirkpatrick-Fleming, will experience significant visual effects, noise effects (for two years and two months) and effects from heavy goods vehicle construction traffic (traffic-related severance for non-motorised users) as a result of the construction of the Proposed Scheme. The sensitivity of this establishment is assessed to be high, as customers may be sensitive to impacts on the local environment and setting. The construction works may discourage them from using this facility. Given the duration of effects and the high level of sensitivity, the Proposed Scheme is assessed to have an adverse significant in-combination effect on this business.

Isolation

6.10.17 No non-agricultural businesses have been identified within the Annandale area that are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

6.10.18 There will be one main civil engineering compound (Annandale depot main compound) and one civil engineering satellite compound in the Annandale area, both of which will continue to be used as railway systems compounds following the completion of civil engineering works. In addition, there will be two further satellite compounds used for railway systems works only. Up to 820 person years of construction employment opportunities will be created at these sites[193], broadly equivalent to 80 full-time jobs[194]. Depending on the skill levels required and the skills of local people, these jobs are potentially accessible to residents in the locality and to others living further afield. The impact of the direct construction employment creation has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).

6.10.19 Direct construction employment could lead to opportunities for local businesses to supply the Proposed Scheme or to benefit from expenditure of construction workers. The impact of indirect construction employment creation has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).

6.10.20 The resulting effects on construction employment are reported in aggregate at a route-wide level (see Volume 3, Route-wide effects).

Permanent effects

Businesses

6.10.21 Businesses directly affected, comprising those that lie within land required for the Proposed Scheme, are reported in groups, where possible, to form defined resources based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier or that similar businesses and resources are clustered together.

6.10.22 Overall, one resource within the study area will experience direct impacts as a result of the Proposed Scheme. This is a plant hire company located to the north of the B7076, east of Kirkpatrick-Fleming.

6.10.23 It is expected that there will be no significant permanent direct effects as a result of land required for the Proposed Scheme. Across all of the employment areas reviewed, it is estimated fewer than 10 jobs[195] will either be displaced or possibly lost within the Annandale area. The impact from the relocation or loss of jobs is considered to be negligible in the

[193] Construction labour is reported in construction person years, where one construction person year represents the work done by one person in a year composed of a standard number of working days.

[194] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

[195] Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency Employment Densities Guide 3rd Edition (2015). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary significantly from actual employment at the sites.

context of the total number of people employed in Dumfries and Galloway (approximately 67,000 jobs) and the scale of economic activity and opportunity in the area.

Other mitigation measures

6.10.24 Businesses displaced by the Proposed Scheme will be compensated in accordance with the Compensation Code. HS2 Ltd recognises the importance of businesses displaced from their existing premises being able to relocate to suitable alternative premises and will, therefore, offer additional support over and above statutory requirements to facilitate this process[196,197]. Businesses with an interest in land that is either being acquired or possessed temporarily for the construction of the Proposed Scheme may also be eligible for compensation in accordance with the Compensation Code.

6.10.25 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents in the Annandale area in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that promotes further economic growth across the UK.

Summary of likely residual significant effects

6.10.26 Likely significant residual effects are shown in Volume 5, Off-route effects Map Book, Map Series SE-01-803 to SE-01-804. During construction, customers may be discouraged from using the Mill Forge hotel and wedding venue in Kirkpatrick-Fleming that is expected to be affected by construction works associated with the Proposed Scheme. This would result in a likely significant adverse residual in-combination effect.

Cumulative effects

6.10.27 No significant cumulative temporary or permanent effects during construction have been identified.

Effects arising from operation

Avoidance and mitigation measures

6.10.28 No mitigation measures are proposed in relation to business resources during operation of the Proposed Scheme.

[196] High Speed Two Ltd (2022), *Phase 2b Western Leg Information Paper C7: Business relocation*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[197] High Speed Two Ltd (2022), *Phase 2b Western Leg Information Paper C8: Compensation code for compulsory purchase.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

Assessment of impacts and effects

6.10.29 No resources are expected to experience significant direct socio-economic, in-combination or isolation effects during the operation of the Proposed Scheme.

Operational employment

6.10.30 Operational employment will be created at locations along the route including stations, train crew facilities and infrastructure/maintenance depots. Within the Annandale area there will be a depot creating 170 HS2-related jobs. These employment opportunities will be accessible to residents within the locality.

6.10.31 Direct operational employment created by the Proposed Scheme could also lead to indirect employment opportunities for local businesses in terms of supplying the project or benefiting from expenditure of directly employed workers on goods and services.

6.10.32 Some of these employment opportunities will be accessible to residents in the locality and, given the transport accessibility within the local area, to residents living further afield.

6.10.33 The impact of operational employment creation has been assessed as part of the route-wide assessment (see Volume 3, Route-wide effects).

Other mitigation measures

6.10.34 No further mitigation measures have been identified for socio-economic receptors.

Summary of likely residual significant effects

6.10.35 There are no significant effects arising during operation of the Proposed Scheme.

Cumulative effects

6.10.36 No significant cumulative effects on socio-economic receptors have been identified in the Annandale area during operation of the Proposed Scheme.

Monitoring

6.10.37 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.10.38 On the basis of there being no significant residual operational effects, there are no area-specific requirements for monitoring socio-economic effects during the operation of the Proposed Scheme in the Annandale area.

6.11 Sound, noise and vibration

Introduction

6.11.1 This section reports the assessment of the noise and vibration likely significant effects arising from the construction and operation of the Proposed Scheme within the area around the Annandale depot on:

- residential receptors such as people, primarily where they live, in terms of individual dwellings and on a wider community basis; and
- non-residential receptors such as:
  - community facilities including schools, hospitals, places of worship and quiet areas; and
  - commercial properties such as hotels.

6.11.2 Non-residential receptors with multiple uses were assessed either based on the most noise sensitive use or were subject to multiple assessments as appropriate.

6.11.3 'Quiet Areas' are defined in the Scope and Methodology Report (SMR)[198] as:

- areas designated under Local Plans[199] as being prized for their tranquillity;
- areas designated under Local Plans or Neighbourhood Development Plans[200] as Local Green Spaces; and
- areas identified as Quiet Areas through implementation of the Environmental Noise (Scotland) Regulations 2006[201,202].

6.11.4 The methodology for the assessment of likely significant noise and vibration effects is consistent with Scottish Government noise policy[203], planning policy and Environmental Impact Assessment (EIA) Regulations as described in the SMR.

6.11.5 Engagement has been undertaken with Dumfries and Galloway Council with respect to the sound, noise and vibration assessment. The purpose of this engagement has been twofold. Engagement has been undertaken covering matters including process, scope, method, approach to baseline, and mitigation strategy. Where appropriate, relevant information identified by the authorities has been taken into account in the assessment. Engagement

[198] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report.*

[199] Local Development Plans in Scotland.

[200] Not applicable in Scotland.

[201] *The Environmental Noise (Scotland) Regulations 2006 (SSI 2006/465).* Available online at: https://www.legislation.gov.uk/ssi/2006/465.

[202] *The Environmental Noise (Scotland) Amendment Regulations 2018 (SSI 2018/342).* Available online at https://www.legislation.gov.uk/ssi/2018/342.

[203] Scottish Government (2011), *Planning Advice Note (PAN) 1 /2011 Planning and Noise,* Available online at: https://www.gov.scot/resource/doc/343210/0114180.pdf (webarchive.org.uk).

with local and county authorities will continue as part of the development of the Proposed Scheme.

6.11.6 More detailed information regarding the sound, noise and vibration assessment for the Annandale area is available in Volume 5:

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-00000); and
- sound, noise and vibration baseline and construction assessment (Appendix SV-001-OR003).

6.11.7 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. Mapping to support the sound, noise and vibration assessment is presented in Map Series SV-03 (Volume 5, Sound, noise and vibration Map Book). The Proposed Scheme is described in Section 6.1.

6.11.8 The assessment of likely significant effects from noise and vibration on agricultural, ecological, heritage receptors and socio-economics and the assessment of tranquillity are presented in agriculture, forestry and soils; ecology and biodiversity; historic environment; socio-economics; and landscape and visual assessments reported in this section.

6.11.9 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

6.11.10 The scope, assumptions and limitations for the sound, noise and vibration assessment are set out in Volume 1, Introduction and methodology, Section 8 and the SMR and Volume 5: Appendix SV-001-00000.

6.11.11 The approach to assessing sound, noise and vibration and identifying envisaged mitigation is outlined in Volume 1, Introduction and methodology, Section 8 and Section 9, and the SMR.

6.11.12 In this assessment ‘sound’ is used to describe the acoustic conditions that people experience as a part of their everyday lives. Noise is taken as unwanted sound and hence adverse effects are noise effects and mitigation is, for example, by noise barriers.

6.11.13 The assessment of construction vibration has been undertaken for residential and non-residential receptors located up to 85m from the nearest construction activity, and up to 200m for non-residential receptors/land uses where low ambient vibration or sound is critical to operations. The assessment of construction noise has been undertaken for residential and non-residential receptors located up to 300m from the nearest construction activity or the area within which the sound levels are forecast to give rise to potential impacts, whichever is greater.

6.11.14 The construction arrangements that form the basis of the assessment are presented in Section 6.1 of this report, in Volume 1, Introduction and methodology, Section 8 and in the draft Code of Construction Practice (CoCP)[204].

6.11.15 The assessment takes account of people's sensitivity to noise during the day, evening and night-time[205]. More stringent criteria are applied during evening and night-time periods, compared to the busier and more active daytime period.

6.11.16 Piling and vibratory compaction is likely to result in short-term appreciable ground-borne vibration at a small number of dwellings, situated very close to these activities. These receptors will also be exposed to appreciable noise from the construction of the Proposed Scheme. The significance of the identified vibration effects has been assessed in-combination with the airborne noise effects also identified at these receptors. The assessment is presented in Volume 5: Appendix SV-001-OR003.

6.11.17 It is likely that the majority of receptors adjacent to the Proposed Scheme are not currently subject to appreciable vibration[206]. The predicted vibration levels at all receptors as a result of the Proposed Scheme has, therefore, been assessed using specific absolute thresholds, below which receptors will not be affected by vibration, rather than vibration change criteria. Further information is provided in Volume 1, Introduction and methodology, Section 8.

6.11.18 Access to undertake surveys to establish the existing baseline at noise sensitive receptors within the Annandale depot area has not been obtained. Therefore, a precautionary approach to the assessment has been undertaken using professional judgement based on alternative, appropriate sources of information.

Environmental baseline

Existing baseline

6.11.19 In the absence of measured baseline sound levels, the approach to the operational and construction assessment is to consider the predicted levels against the minimum lowest observed adverse effect level (LOAEL) defined in the SMR for the relevant parameter. The LOAEL values used in the assessment of direct construction noise and vibration effects generated by on-site activities, are adjusted in higher baseline noise environments and so an assessment assuming low baseline sound levels will potentially overestimate the number of likely significant effects. Where appropriate publicly available information, such as Scottish

[204] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

[205] Day, evening and night-time periods are defined in Volume 5: Appendix SV-001-00000, Sound, noise and vibration methodology, assumptions and assessment.

[206] Further information is available in the Volume 5: Appendix SV-001-00000, *Sound, noise and vibration methodology, assumptions and assessment report* and the Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report.*

Government noise mapping data, has been used to influence the determination of the assessment criteria.

Future baseline

6.11.20 Committed developments involving sound or vibration sensitive uses within the relevant study area have been included within the assessment and are reported for the Annandale area in Volume 5: Appendix SV-001-OR003[207]. Where applicable, noise or vibration significant effects on these committed developments are discussed in this section.

6.11.21 The peak level of construction traffic activity for the Proposed Scheme is expected to occur in 2028.

Effects arising during construction

Avoidance and mitigation measures

6.11.22 The assessment assumes the implementation of the principles and management processes set out in the noise and vibration section of the draft CoCP, Section 13, which are:

- best practicable means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA), which will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties and other sensitive receptors (including local businesses and quiet areas designated by the local authority);
- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example, the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on-site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings;
  - screening: for example, local screening of equipment or perimeter hoarding or the use of temporary stockpiles; and
  - where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary rehousing will be offered at qualifying properties.
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of the CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise and vibration, including control of working hours, and provide a further assessment of construction noise and vibration, including confirmation of noise insulation/temporary rehousing provision;

[207] Volume 5: Appendix CT-004-OR003 provides details of all of the developments assumed to implemented.

- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to, and be reviewed by, the nominated undertaker and made available to the local authorities; and
- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the nominated undertaker as required to ensure compliance.

6.11.23 Noise insulation will be offered for qualifying buildings as defined in the draft CoCP. Noise insulation or, where appropriate, temporary rehousing will avoid residents being significantly affected by levels of construction noise inside their dwellings. The assessment reported in this section provides an estimate of the buildings that are likely to qualify for noise insulation. The assessment shows that none are predicted to qualify for noise insulation or temporary rehousing.

6.11.24 Qualification for noise insulation and, where appropriate, temporary rehousing will be confirmed, as part of seeking prior consent from the local authority under Section 61 of the CoPA. Qualifying buildings will be identified, as required in the draft CoCP, so that noise insulation can be installed, or where appropriate any temporary rehousing provided, before the start of the works predicted to exceed noise insulation or temporary rehousing criteria.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings and communities

6.11.25 The avoidance and mitigation measures to be implemented during construction will reduce airborne construction noise adverse effects on individual dwellings and communities, to an extent that the assessment of construction noise and vibration indicates that significant sound, noise or vibration effects are unlikely to occur on any individual dwellings or community in this area. Further information on the assessment of effects on individual dwellings is presented in Volume 5: Appendix SV-001-OR003.

Residential receptors: indirect effects

6.11.26 Construction traffic is not likely to cause adverse noise effects on any occupants of dwellings in the Annandale area.

Non-residential receptors: direct effects

6.11.27 The assessment has identified The Mill Forge hotel and wedding venue (Assessment Location reference: 614000) as a non-residential receptor where the predicted airborne noise levels exceed both the relevant impact screening criteria and the noise change

criterion (typically a change of greater than 3dB[208] compared with the existing baseline sound level). The location is identified in the Annandale area, as shown in Volume 5, Sound noise and vibration Map Book, Map Series SV-03.

6.11.28 At the non-residential receptor identified above an assessment has been undertaken to determine if this impact will result in a significant effect, using the significance criteria set out in Annex A of Volume 5: Appendix SV-001-00000.

6.11.29 The Mill Forge hotel and wedding venue comprises a hotel, bar and a wedding chapel. The Mill Forge site perimeter is located approximately 25m from the land required for the construction of the Proposed Scheme. The venue has been assessed against the places of meeting for religious worship criteria. The predicted daytime monthly construction noise level is above the screening criteria defined in the SMR for places of meetings for religious worship[209] for a period of two years and two months. The typical and highest predicted daytime monthly construction noise level are 4dB(A) and 10dB(A) respectively above the screening criteria defined in the SMR. The northern facade faces the Proposed Scheme and comprises a one-storey brick building with large single glazed openable windows. Weddings are hosted indoors and outdoors on the western section of the site, more than one wedding can be accommodated simultaneously. The Mill Forge hotel and wedding venue is identified, on the basis of a precautionary assessment, as being subject to a likely significant adverse effect (denoted by ADEP-C-N1 in Table 4, Volume 5: Appendix SV-001-OR003). This temporary adverse effect may take the form of activity disturbance to users of the hotel.

Non-residential receptors: indirect effects

6.11.30 Construction traffic is not likely to cause adverse noise effects on any non-residential receptors in the Annandale area.

Summary of likely residual significant effects

6.11.31 The proposed avoidance and mitigation measures will reduce noise inside all dwellings from the construction activities such that residents will not be significantly affected[210].

6.11.32 At the community level, the measures will also reduce the construction noise effects on acoustic character in the majority of residential communities. The assessment of construction noise and vibration indicates that significant sound, noise or vibration effects are unlikely to occur on communities in this area.

[208] The exception is where the use and sensitivity of the receptor or land use is very sensitive to noise and have been included in the detailed assessment where there is a change less than 3dB. Further information can be found in Volume 5: Appendix SV-001-OR003.

[209] 50dB $L_{pAeq,\ 0700\ –\ 2300}$ (free-field) during the day which is equivalent to 53dB $L_{pAeq,\ 0700\ –\ 2300}$ (facade).

[210] Refer to Volume 5: Appendix SV-001-00000, Sound, noise and vibration methodology, assumptions and assessment.

6.11.33 Noise from specific construction activities has been identified as resulting in significant residual temporary effects on the non-residential buildings at The Mill Forge hotel and wedding venue.

6.11.34 HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures.

Other mitigation measures

6.11.35 No other mitigation measures are proposed in this area.

Cumulative effects

6.11.36 This assessment has considered the potential cumulative construction noise effects of the Proposed Scheme and other committed developments[211]. It is not anticipated that there will be any significant cumulative noise effects during construction of the Proposed Scheme.

Effects arising from operation

Assessment of impacts and effects

6.11.37 Given the nature of the works, direct and indirect operational effects are not anticipated and therefore no assessment is presented for the works associated with the Proposed Scheme in this section of the report.

Monitoring

6.11.38 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.11.39 Operational noise and vibration monitoring will be carried out at different times during the lifetime of the Proposed Scheme at a combination of carefully selected monitoring locations. The locations will be: adjacent or attached to moving vehicles, at fixed positions or in the vicinity of individual assets; and locations within the surrounding areas and communities alongside the railway corridor.

6.11.40 The expected noise and vibration performance of the Proposed Scheme, operational noise and vibration measurement data, associated asset information, description of corrective actions, results of measured performance compared to expected conditions, and monitoring reports will be shared with the relevant local authorities at appropriate intervals.

[211] Refer to Volume 5: Appendix CT-004-OR003, Planning data.

6.12 Traffic and transport

Introduction

6.12.1 This section considers the likely impacts on all forms of transport and the consequential potential significant effects on transport users arising from the construction and operation of the Proposed Scheme within the Annandale area. The effects on traffic and transport are assessed quantitatively, based on existing baseline traffic conditions and future scenarios.

6.12.2 Engagement with Transport Scotland and Dumfries and Galloway Council (DGC) has been undertaken. An important focus of this engagement has been to obtain relevant baseline information and discuss transport survey requirements and assessment methodology.

6.12.3 A detailed report on traffic and transport impacts within the Annandale area is contained in Volume 5: Appendix TR-001-000, Transport Assessment Part 4.

6.12.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book.

6.12.5 Maps showing traffic and transport significant effects during construction (Map Series TR-03) and operation (Map Series TR-04) and construction routes to compounds (Map Series TR-08) can be found in Volume 5, Traffic and transport Map Book.

6.12.6 In addition, further traffic and transport data are set out in Background Information and Data (BID)[212], (see BID TR-004-00001: Transport Assessment policy and data).

6.12.7 The Proposed Scheme is described in Section 6.1.

Scope, assumptions and limitations

6.12.8 The scope, assumptions and limitations for the traffic and transport assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report[213].

6.12.9 The peak level of construction traffic activity for off-route works is expected to be 2028 and the opening year to be 2038. The forecasts used in the assessment have been produced prior to the development of a full understanding of the likely impact of COVID-19 on economic growth and travel behaviour. The full impact of COVID-19 is not yet known but is considered likely to result in lower travel demand in the medium term than the forecasts used in the assessment for background traffic and rail, including HS2.

[212] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[213] Volume 5: Appendix CT-001-00001, *Environmental Impact Assessment Scope and Methodology Report*.

6.12.10 The study area for traffic and transport includes the area immediately surrounding the Proposed Scheme and construction traffic routes connecting with the strategic road network. The A74(M) is the only strategic road within the Annandale area (see Volume 4, Off-route effects Map Book, Map CT-06-806).

6.12.11 For all roads, the baseline forecast traffic flows for the future years of assessment have been derived using the Department for Transport's (DfT) traffic forecasting tool, Trip End Model Presentation Program (TEMPro). The assessment covers the average weekday morning (08:00 – 09:00) and evening (17:00 – 18:00) peak hours.

6.12.12 Forecast future year traffic flows in this off-route assessment, with and without the Proposed Scheme, have been based on an approach that does not take account of wider effects such as redistribution and reassignment of traffic. This is consistent with the assessment of other phases of HS2. It is not considered that these wider changes will affect the conclusion of the assessment.

6.12.13 Where the effects vary through the construction programme the most significant effects are reported. Where there are both adverse and beneficial effects at different times, the most adverse and least beneficial are both reported.

Environmental baseline

Existing baseline

6.12.14 Existing conditions in the study area have been determined through site visits, traffic and transport surveys, liaison with Transport Scotland and DGC (including provision of information on public transport, public rights of way (PRoW) and core paths and accident[214] data) and desktop analysis.

Surveys

6.12.15 Traffic surveys, comprising junction turning counts, manual classified counts, queue length surveys and automatic traffic counts, were undertaken in November and December 2020. These data have been supplemented by existing traffic data from other sources, including from Transport Scotland. Assessment of the data indicates that the weekday peak hours in the area are generally 08:00-09:00 and 17:00-18:00 which correspond to the Proposed Scheme assessment hours.

6.12.16 Core path surveys were undertaken in the Annandale area to establish their nature and usage by non-motorised users (pedestrians, cyclists and equestrians). The surveys included core paths that may be affected by the Proposed Scheme.

[214] The term accident in this report refers to injury related collisions reported to/recorded by the police. These data, known as STATS19, relate only to personal injury accidents on public roads that are reported to the police, and subsequently recorded, using the STATS19 accident reporting form.

Strategic and local highway network

6.12.17 The A74(M) is the only strategic route that passes through the Annandale area, and is generally free flowing at peak times.

6.12.18 The local roads include:

- B7076; and
- B6357.

6.12.19 The local road network in this area generally operates well and is generally free flowing at peak times.

6.12.20 Relevant accident data for the road network subject to assessment have been obtained from the DfT[215]. Data for the three-year period from July 2016 to June 2019 have been assessed and any identified clusters (i.e. where there are nine or more accidents in the three-year period) have been examined.

6.12.21 No accident clusters were identified within the Annandale area.

Parking and loading

6.12.22 There is no parking or loading identified within the Annandale area that is expected to be impacted by the Proposed Scheme. Consequently, this topic is not considered further in this assessment.

Public transport network

6.12.23 One bus route, service 382, operates on the B7076 adjacent to the land required for the operation of the Proposed Scheme. There are also bus stops primarily located to serve the built-up areas of Gretna and Kirkpatrick-Fleming. Where bus routes and stops are expected to be affected by either the construction or operation of the Proposed Scheme, these are referred to in the relevant assessment sections.

6.12.24 Local rail services are accessible via Gretna Green Station, which provides access to local services to Newcastle, Carlisle, Dumfries and Glasgow.

Non-motorised users

6.12.25 There are footways adjacent to many of the roads in the built-up areas of Gretna and Kirkpatrick-Fleming. Roadside footways vary in width and condition within these areas. Where there is no formal footway provision adjacent to a road, non-motorised user numbers are generally low.

[215] Department for Transport (2021), *STATS19 Road Safety Data July 2016 - June 2019*. Available online at: https://www.gov.uk/government/collections/road-accidents-and-safety-statistics.

6.12.26 National Routes 7 and 74 (part of the National Cycle Network) connecting Glasgow with Gretna and Carlisle, pass through the Annandale area.

Waterways and canals

6.12.27 There are no navigable waterways within the Annandale area potentially affected by the Proposed Scheme. Consequently, this topic is not considered further in this assessment.

Air transport

6.12.28 There is no relevant air transport within the Annandale area. Consequently, this topic is not considered further in this assessment.

Future baseline

6.12.29 The future baseline traffic volumes have been calculated for the future years of 2028, 2038 and 2046. These have been used to support the assessment of construction and operation of the Proposed Scheme, reflecting the assumed construction peak (2028), opening year (2038) and a future assessment year (2046). Growth factors have been checked to ensure that committed developments are appropriately reflected in the growth forecasts. The assumptions underlying committed developments and transport schemes for each assessment year have been discussed with DGC and are considered to be appropriately reflected in the traffic forecasts.

6.12.30 It is difficult to forecast how public transport services may change in the future; therefore, unless information on future services is available, it has been assumed that public transport services for the future years of assessment will be the same as those currently operating. Similarly, pedestrian demand and facilities and parking are assumed to remain unchanged from the base year. For the Annandale area, there are no known substantial committed changes to the transport network.

Construction

6.12.31 Construction of the Proposed Scheme is expected to commence in 2025 with construction activity continuing to 2031. Construction activities have been assessed against 2028 baseline traffic flows, irrespective of when they occur during the construction period.

6.12.32 The year 2028 is the common base year for off-route works and the impact of individual or overlapping activities is considered against this single year.

6.12.33 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 4% by 2028 compared to a baseline year of 2020.

Operation (2038 and 2046)

6.12.34 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 8% by 2038 compared to a baseline year of 2020.

6.12.35 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 11% by 2046 compared to a baseline year of 2020.

Effects arising during construction

Avoidance and mitigation measures

6.12.36 The following measures are currently proposed to avoid or reduce effects on transport users:

- new highways will be constructed and operational prior to the permanent closure of any existing highways, insofar as reasonably practicable;
- traffic management measures will be implemented to limit any disruption;
- road closures will be restricted to overnight and weekends, insofar as reasonably practicable;
- heavy goods vehicles (HGV) will be routed, insofar as reasonably practicable, along the strategic and/or primary road network;
- the use of the local road network will, insofar as reasonably practicable, be limited to use for site set-up, access for surveys and ongoing servicing (including refuse collection and general deliveries to compounds) during construction;
- highway measures including junction improvements, passing places and carriageway widening will be provided, as required, to manage the safe passing of construction vehicles on construction HGV routes; and
- on-site welfare facilities will be provided, which will reduce daily travel by site workers.

6.12.37 Section 14 of the draft Code of Construction Practice[216] (CoCP) includes measures that aim to reduce the adverse impacts and effects on local communities and maintain public access. This includes the impacts of deliveries of construction materials and equipment.

6.12.38 The measures in the draft CoCP include controls on vehicle types, hours of site operation and routes for HGVs to reduce the impact of road-based construction traffic. In order to achieve this, general and site-specific traffic management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads and PRoW affected by the Proposed Scheme.

6.12.39 The draft CoCP includes the requirement to develop local traffic management plans in consultation with the highway and traffic authorities and the emergency services. These will consider the local traffic management strategy including consideration of sensitive receptors, such that adverse impacts will be reduced, insofar as reasonably practicable.

6.12.40 Specific measures include core site operating hours of 08:00 to 18:00 on weekdays and 08:00 to 13:00 on Saturdays with site staff and workers generally arriving before the morning peak hour and departing after the evening peak hour. Activities such as major concrete pours may

[216] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

involve extended working hours for reasons of engineering practicability. However, workers will mostly arrive and depart outside of the peak traffic hours.

6.12.41 The number of private car trips to and from the construction compounds (both workforce and visitors) will be reduced by encouraging alternative sustainable modes of transport or vehicle sharing. This will be supported by an overarching framework travel plan that will require construction workforce travel plans to be produced that will include a range of potential measures to mitigate the impacts of workers' traffic and transport movements associated with construction of the Proposed Scheme. The travel plans will promote the use of sustainable transport modes as appropriate to the location and types of trip. They will include measures such as: provision of information on and promotion of public transport services; liaison with public transport operators; provision of good cycle and pedestrian facilities; promotion of car sharing; and the appointment of a travel plan coordinator to ensure suitable measures are in place and are effective.

6.12.42 Where works potentially affect Network Rail assets, disruption to travelling passengers and freight movements will be reduced insofar as reasonably practicable. This includes measures such as:

- programming the construction works to coincide with the possessions that are required and planned by Network Rail for the general maintenance of their railway;
- planning the required construction works so that they can be undertaken in short overnight stages so that passenger services are not disrupted; and
- programming longer closures at the weekend and on bank holidays to reduce insofar as reasonably practicable the number of passengers affected.

Assessment of impacts and effects

Temporary effects

6.12.43 The following section considers the impacts on traffic and transport and the likely consequential significant effects resulting from the construction of the Proposed Scheme.

Key construction transport issues

6.12.44 The traffic and transport impacts during the construction period within the Annandale area will include:

- construction vehicle movements to and from the various construction compounds; and
- possessions on the conventional rail network resulting in impacts on users of the adjacent rail networks.

6.12.45 Construction vehicle movements required to construct the Proposed Scheme will include the delivery of plant and materials, movement of excavated materials and site worker trips. Works will also include utility works, earthworks and highway construction.

6.12.46 Details of the construction compounds are provided in Section 6.1. Table 35 details of the compound set up date and the duration of active use. The duration of active use excludes any period where there are no substantial workforce trips or movement of materials to and from the compound.

6.12.47 Table 35 also provides a summary along with the HGV and car/light goods vehicle (LGV) access trips at each compound in the peak month of activity and during the busy period. For each compound, the peak month of activity is the month within which HGV traffic is at its highest for that compound. The busy period is the period during which HGV traffic serving that compound will be greater than 50% of the HGV traffic in the peak month. Two-way trips refer to the total number of vehicle movements in both directions (i.e. with 200 westbound vehicles and 100 eastbound, there would be 300 two-way trips). The average daily combined two-way vehicle trips for the busy period is the lower end of the range shown in Table 35 and the average daily combined two-way vehicle trips for the peak month is the upper end of the range shown. The estimated duration of busy period is also provided.

Table 35: Typical vehicle trip generation for construction compounds within the Annandale area

Compound type	Compound name	Indicative start/set- up date (years/ quarters)	Estimated duration of active use (years/ months)	Average daily combined two–way car/LGV trips during busy period and within peak month of activity	Average daily combined two–way HGV trips during busy period and within peak month of activity	Estimated duration of busy period (years/ months)
Satellite	Quintinshill Sidings satellite compound	2030 Q2	9 months	147-147	4-4	6
Satellite	Cranberry Farm accommodation overbridge satellite compound	2027 Q3	3 years	84-94	13-16	9
Main	Annandale depot main compound	2027 Q2	4 years 6 months	218-386	405-424	16
Satellite	Cove Crossing satellite compound	2030 Q2	9 months	147-148	4-4	6

6.12.48 Table 36 summarises the access routes to and from each compound to the main road network. For some compounds, Table 36 includes multiple construction routes. This is either because the construction route varies depending on the origin/destination of the trip or because the construction route varies over time to account for changes to the highway network through the construction period.

6.12.49 The average daily combined two-way vehicle trips reported in Table 35 represent the total number of vehicle movements to and from each compound during the busy period and in the peak month of activity on all of the available construction routes combined. Where multiple routes are shown in Table 36, the split of construction traffic between the available routes will vary based on the point in the construction programme and the origin/destination of the traffic.

Table 36: Construction routes for construction compounds within the Annandale area

Compound name(s)	Access routes to / from compound(s) to main road network
Quintinshill Sidings satellite compound	Unnamed road serving Quintinshill, B7076, Gretna Green motorway services access road, A74(M)
Cranberry Farm accommodation overbridge satellite compound Annandale depot main compound	Route to/from the south: • B7076 and A74(M) junction 21 Route to/from the north: B7076, Gretna Green motorway services access road and A74(M)
Cove Crossing satellite compound	Unnamed road serving Cove Crossing, B7076, B6357 and A74(M) junction 21

6.12.50 Information on the indicative construction programme is provided in Section 6.1 and the construction methodology is summarised in Volume 1, Introduction and methodology, Section 6. This illustrates how the phasing of activities at different compounds will generally be staggered and that construction activities at individual compounds may not occur over the whole duration presented in Table 35.

6.12.51 The assessment of the effects of construction of the Proposed Scheme on the highway network in the Annandale area is based on the highest volume of construction traffic on each construction route during the construction period. Where construction routes will serve more than one construction compound, the assessment is based on the highest combined volume of construction traffic on each section of each route during the construction period.

Highway network

Strategic and local highway network

6.12.52 The primary HGV access routes for construction vehicles will be the strategic and/or primary road network with the use of the local road network limited, insofar as reasonably practicable. The construction routes will also provide access to compounds. In this area, it is proposed that the main construction routes will be:

- B7076 (between unnamed road serving Quintinshill and unnamed road serving Cove Crossing);
- B6357 (between the A74(M) junction 21 and the B7076);
- unnamed road serving Quintinshill;
- unnamed road serving Cove Crossing; and
- A74(M) Gretna Green motorway services access road.

6.12.53 A number of these construction routes will have limited use (i.e. a low level of HGV use generally over a short length of time, for example for site set-up or minor works) including the B6357, the unnamed road serving Quintinshill and the unnamed road serving Cove Crossing.

6.12.54 In addition to increases in traffic flows due to construction traffic, temporary highway closures and diversions or realignments will be required in a number of locations as set out in Section 6.1. The works to construct both temporary and permanent highway diversions/realignments could also result in disruption to highway users. In most cases, these works will be restricted to short-term overnight and/or weekend closures, and are not, therefore, considered significant. Where works will be of a longer duration and/or are predicted to have a significant effect, these are addressed below.

6.12.55 The B7076 carriageway will be widened to provide a new dedicated traffic lane for right turning traffic in the centre of the carriageway (ghost island) to provide access to the Proposed Scheme. The construction of the permanent access will not result in any significant effects with regard to increased journey times for vehicle occupants.

6.12.56 The movement of excavated or fill material and construction vehicles accessing construction compounds in the construction of the Proposed Scheme together with temporary road closures and diversions is expected to result in changes in daily traffic flows.

6.12.57 However, these changes in daily traffic flow will not lead to increases in delay to vehicle occupants and congestion at any junction and are not predicted to result in any significant effect on traffic flows and delays to vehicle occupants.

6.12.58 Construction of the Proposed Scheme will result in substantial increases in traffic flows (i.e. more than 30% for HGV or for all vehicles) in three locations, which can lead to traffic-related severance for non-motorised users. The effects, which are significant are listed below for the identified roads and are the most significant adverse traffic-related severance effect for non-motorised users:

- B7076 (between Annandale depot main compound access and Gretna Green motorway services access road) – major adverse effect (HGV);
- B7076 (between A74(M) junction 21 northbound off-slip and Annandale depot main compound access) – moderate adverse effect (HGV); and
- unnamed road serving Cove Crossing – moderate adverse effect (all vehicles).

6.12.59 Utilities works have been included in the assessment where they are major and where the traffic or transport impacts from the works separately, or in combination with other works, will be greater than other construction activities arising within the area. All utilities works are expected to result in only localised traffic and pedestrian diversions, which will be of short-term duration and are not expected to result in significant effects.

Accidents and safety

6.12.60 The effect of the Proposed Scheme on accident and safety risks will not be significant as there are no locations where there are both accident clusters and substantial increases in traffic during construction.

Public transport network

6.12.61 Construction of the Proposed Scheme will not result in any significant effects upon the operation of existing bus services or stops.

6.12.62 There are interfaces with the existing rail network in this area, in particular on the operation of the WCML and its passengers and rail freight services.

6.12.63 The construction of the Proposed Scheme, in particular the tie-in with the WCML, is expected to require a number of rail possessions over a period of up to eight months in this area. This will include six possessions of 27 hours, four possessions of 54 hours, and one possession of 72 hours, affecting all lines. The works will include track works, overhead line wiring and commissioning.

6.12.64 Disruption to rail users will be reduced by limiting possessions, where reasonably practicable, to existing maintenance periods. Possessions will affect users of the WCML and will be managed through a combination of measures, which could include rail service diversions and replacement bus services, which will reduce the disruption to the travelling public. Since users of the WCML will be affected by possessions and blockades in the Annandale area and other community areas the effects of these are reported in Volume 3, Route-wide effects, Section 14.

6.12.65 HS2 Ltd will work with Network Rail and the train operating companies and freight operating companies to ensure that any need for additional possessions can be reduced with good planning and communication (including appropriate advance notice).

Non-motorised users

6.12.66 The construction works associated with the Proposed Scheme will not require the temporary closure or diversion/realignment of PRoW, core paths or roads. Therefore, there will not be a significant severance effect on users.

Permanent effects

6.12.67 Any permanent effects of construction are considered in the assessment of operation for traffic and transport. This is because the impacts and effects of ongoing increases in travel demand and the wider impacts and effects of the operational phase need to be considered together.

Other mitigation measures

6.12.68 The implementation of the measures in the draft CoCP, including travel plans, will help mitigate the transport-related effects during construction of the Proposed Scheme.

6.12.69 No further traffic and transport mitigation measures during construction of the Proposed Scheme are considered appropriate.

Summary of likely residual significant effects

6.12.70 The temporary residual significant effects during construction remain as described above. These effects will be temporary and reversible in nature lasting only for the duration of the construction works.

6.12.71 Increases in traffic during the construction period will result in the following temporary effects, which are significant, on traffic-related severance for non-motorised users:

- major adverse effects on one road: part of the B7076; and
- moderate adverse effects on two roads.

6.12.72 Since the WCML will be affected by possessions and blockades in the Annandale depot area and other community areas the effects of these are reported in Volume 3, Route-wide effects, Section 14.

Cumulative effects

6.12.73 The assessment includes the cumulative effects of planned and committed development during construction by taking this into account within the background traffic growth.

6.12.74 The assessment also takes into account Proposed Scheme construction traffic and transport impacts of works to construct the Proposed Scheme being undertaken in neighbouring community areas.

Effects arising from operation

6.12.75 This section presents the likely significant environmental effects from the operation of the Proposed Scheme within the Annandale area in 2038 and 2046.

Avoidance and mitigation measures

6.12.76 The following measures have been included as part of the design of the Proposed Scheme and will avoid or reduce impacts on transport users:

- reinstatement of roads on or close to their existing alignments, where reasonably practicable; and
- provision of pick up/set down, cycle and pedestrian facilities.

6.12.77 A depot travel plan for the Proposed Scheme will be developed and will include measures that aim to reduce the impacts and effects of traffic and transport movements.

Assessment of impacts and effects

6.12.78 The following section considers the impacts on traffic and transport and the consequential effects resulting from the operational phase of the Proposed Scheme in 2038 and 2046.

Key operation transport issues

6.12.79 The operation and maintenance of the Proposed Scheme will generate additional vehicle movements due to staff, servicing and operational traffic.

Highway network

Strategic and local highway network

6.12.80 The Proposed Scheme will require the permanent widening of the B7076 to accommodate access to the Annandale depot but will not result in any significant effects with regard to increased journey times for vehicle occupants.

6.12.81 The Proposed Scheme will generate additional vehicle movements due to staff, servicing and operational traffic. The Annandale depot is expected to operate on a shift pattern, with the busiest shift changeovers occurring outside of the morning and evening peak periods on the local road network. However, some Annandale depot related traffic will be generated during the peak hours, leading to flow changes on the highway network. This will not, however, result in any significant effect on congestion or delays in either 2038 or 2046.

6.12.82 A change in traffic levels can result in changes to traffic-related severance for non-motorised road users, particularly pedestrians using or seeking to cross a road. The permanent highway changes are forecast to result in increases in peak hour traffic flow (more than 10% for all vehicles) that will result in increases in pedestrian severance, which are significant, as set out in Table 37.

Table 37: Roads with changes in traffic flow resulting in effects on non-motorised user severance, 2038 and 2046

Road name	2038 AM peak hour	2038 PM peak hour	2046 AM peak hour	2046 PM peak hour
B7076 (between B6357 and A74(M) junction 21)	Minor adverse	Minor adverse	Minor adverse	Minor adverse
B7076 (between A74(M) junction 21 and Annandale depot site access)	Major adverse	Moderate adverse	Major adverse	Moderate adverse
B7076 (between Annandale depot site access and Gretna Loaning)	Minor adverse	Minor adverse	Minor adverse	Minor adverse

Accidents and safety

6.12.83 The effect on accident and safety risk will not be significant as there are no locations within the Annandale area where there is a substantial forecast increase in traffic due to the operation of the Proposed Scheme.

Non-motorised users

6.12.84 The Proposed Scheme will not result in permanent highway changes that will affect pedestrians and cyclists.

Other mitigation measures

6.12.85 No further traffic and transport mitigation measures are considered appropriate for the operation of the Proposed Scheme based on the outcome of the assessment.

Summary of likely residual significant effects

6.12.86 Changes in traffic during operation of the Proposed Scheme will result in the following effects, which are significant, on traffic severance for non-motorised users in 2038:

- major adverse effects on one road: part of the B7076; and
- minor adverse effects on two roads.

6.12.87 The residual significant effects for non-motorised users in 2046 will be:

- major adverse effects on one road: part of the B7076; and
- minor adverse effects on two roads.

Cumulative effects

6.12.88 The assessment includes cumulative effects of planned and committed development during operation, by taking into account background traffic growth in the future baseline.

Monitoring

6.12.89 Volume 1, Introduction and methodology, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.12.90 A depot travel plan will detail monitoring of travel associated with operation of the Proposed Scheme.

6.12.91 There are no other area-specific monitoring requirements currently proposed for traffic and transport.

6.13 Water resources and flood risk

Introduction

6.13.1 This section provides a description of the current baseline for water resources within the Annandale area. Flood risk has been scoped out of this assessment as the Proposed Scheme will not impact on sensitive existing receptors. The likely impacts and significant effects identified arising from the construction and operation of the Proposed Scheme on surface water, groundwater and the Water Framework Directive (WFD) are reported.

6.13.2 Engagement has been undertaken with:

- the Scottish Environment Protection Agency (SEPA);
- Dumfries and Galloway Council; and
- Scottish Water.

6.13.3 The purpose of this engagement was to obtain relevant baseline information and to discuss the Proposed Scheme and potential effects. The engagement has informed the assessments, including issues such as the WFD risks associated with Ewes Burn.

6.13.4 Maps showing the location of the key environmental features (Map Series CT-10), and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book.

6.13.5 Map Series WR-01, WR-02, and WR-03, showing details of the water features referred to in this section, are contained in the Volume 5, Water resources and flood risk Map Book.

6.13.6 Detailed information on the water resources issues specific to the Annandale area are contained in Volume 5 appendices. These comprise:

- Appendix WR-001-OR003 – Water Framework Directive preliminary compliance assessment; and
- Appendix WR-003-OR003 – Water resources assessment.

6.13.7 The Water Framework Directive preliminary compliance assessment (Appendix WR-001-OR003) sets out the regulatory requirements for the Water Framework Directive (WFD) in Scotland. A detailed description of the WFD compliance assessment scope and methodology is provided in the EIA Scope and Methodology Report (SMR), WFD Compliance Assessment Technical Note (Volume 5, Appendix CT-001-00001).

6.13.8 Volume 5 also includes a draft route-wide water resources and flood risk operation and maintenance plan (Appendix WR-007-00000).

6.13.9 In addition, the following documents are provided as Background Information and Data (BID)[217]:

- BID WR-002-OR003 – Water Framework Directive preliminary compliance assessment baseline data; and
- BID WR-004-OR003 – Water resources baseline.

6.13.10 Volume 3, Route-wide effects, Water resources and flood risk (Section 16) covers the risk to water resources associated with accidents or spillages from trains during operation of the Proposed Scheme.

[217] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

6.13.11 The Proposed Scheme is described in Section 6.1.

6.13.12 All distances, lengths and area measurements in this section are approximate.

Scope, assumptions and limitations

6.13.13 The scope, assumptions and limitations for the water resources and flood risk assessment are set out in Volume 1, Introduction and methodology, Section 8 and the EIA Scope and Methodology Report (SMR).

6.13.14 Unless indicated otherwise, the spatial scope of the assessment (the study area) is based upon the identification of surface water and groundwater features within 1km of the land required for the construction of the Proposed Scheme, as described in Section 6.1 of this report.

6.13.15 This assessment is based on desk study information, including information provided by consultees and stakeholders. Access to land for surveys of the Annandale area has not been obtained.

6.13.16 A precautionary approach has been used in the assessment to identify impacts and effects where there is limited information. Where surveys have not been undertaken due to land access constraints, a precautionary approach has been adopted in the assessments of receptor value and impact magnitude. In the absence of baseline data, it is assumed that potential water resources receptors are present close to the land required for the construction of the Proposed Scheme and impact magnitude assessed accordingly. The highest applicable value is assigned to these potential receptors. Where this precautionary approach indicates the requirement for mitigation, preliminary mitigation is described, which may include further data collection and/or assessment to refine mitigation, where appropriate.

6.13.17 Groundwater levels have been inferred from the nearby SEPA groundwater level monitoring borehole, historic borehole logs and topographic data, as well as from spring and watercourse locations. Where data are not available, groundwater levels have been assumed to be at ground level. This constitutes a reasonable worst-case basis for the subsequent assessment.

6.13.18 The hydrological impacts on biological receptors such as aquatic fauna and flora are referred to in the Volume 5: Appendix WR-003-OR003 Water resources assessment and the Volume 5: Appendix WR-001-OR003, WFD preliminary compliance assessment. Where these impacts have the potential to result in significant effects these are described in Section 6.5, Ecology and biodiversity, together with any other mitigation required.

6.13.19 Impacts from existing land contamination which lead to significant effects on groundwater quality are presented in the land quality assessment reported in Section 6.7.

Environmental baseline

Existing baseline – water resources

Surface water

6.13.20 All surface water bodies in the study area fall within the Gretna Coastal catchment of the Solway Tweed river basin district (RBD). The current river basin management plan[218] identifies the status of surface water bodies, and the status of groundwater bodies within this RBD.

6.13.21 The statutory objective of the WFD[219] is to achieve 'good status' for all designated water bodies. The purpose of the WFD preliminary compliance assessment[220] is to demonstrate that the Proposed Scheme does not result in a deterioration in current water body status, and that water bodies are not prevented from achieving status objectives.

6.13.22 In the absence of field surveys, surface water bodies, other than minor ponds and ditches, have been identified within this assessment as being of either moderate, high or very high value on a precautionary basis.

6.13.23 Summary information relating to the surface water bodies potentially affected by the Proposed Scheme within the study area is provided in Table 38. The receptor value attributed to each individual water body is based on the methodologies set out in the SMR. The feature locations are indicated by the grid coordinates on the relevant Volume 5, Water resources and flood risk Map Book: Map Series WR-01, at the point closest to the Proposed Scheme.

[218] Natural Scotland and the Environment Agency (2015), *The river basin management plan for the Solway Tweed river basin district 2015 update.* Available online at: https://www.sepa.org.uk/media/218890/rbmp_solway_tweed_2015.pdf.

[219] *Water Environment and Water Services (Scotland) Act 2003 (WEWS Act) and supporting Regulations.* Available online at: https://www.legislation.gov.uk/asp/2003/3/contents.

[220] Volume 5: *Appendix WR-001-OR003 Water Framework Directive preliminary compliance assessment*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

Table 38: Surface water body receptors

Water body name and location	Type (at point closest to the Proposed Scheme)	Q95 value (m^3/s)[221]	Receptor value	Parent WFD water body name and identification number (ID)[222]	Current WFD status/ objective[223]	Crossed by the Proposed Scheme?
Kirkpatrick Burn WR-01-803 C5 and C6	Minor watercourse	0.013	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	No
Tributary of Kirkpatrick Burn WR-01-803 C6	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	No
Ewes Burn WR-01-803 E6 and F6	Minor watercourse	0.004	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	Yes
Tributary of Ewes Burn 1 WR-01-803 E6	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	Yes
Tributary of Ewes Burn 2 WR-01-803 F5 and F6	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	Yes
Stand Burn WR-01-803 F7 and F8	Minor watercourse	0.006	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	No
Tributary of Stand Burn WR-01-803 F8	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	No
Kirtle Water WR-01-803 D7 and E8	River	0.14	High	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	No
Tributary of Kirtle Water 1 (Irvington) WR-01-803 B6	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	No
Tributary of Kirtle Water 2 (Gretna Services) WR-01-803 G7	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/good by 2027	No

[221] This is the flow within the watercourse that is exceeded for 95% of the time. The Q95 has been provided as an indication of watercourse size but is only one of several criteria used to inform receptor value. Other criteria include the WFD watercourse classification which takes into account the value of any habitat which the watercourse supports. Details are provided in the Volume 5: Appendix CT-001-00001, Environmental Impact Assessment Scope and Methodology Report.

[222] SEPA has attributed each surface water and groundwater body a unique water body identification (ID) number.

[223] Status and objectives are based on those set out in the 2015 river basin management plan (RBMP). The 2015 RBMP is the most up to date and will updated by SEPA in 2021.

Abstractions and permitted discharges (surface water)

6.13.24 Table 39 sets out the surface water abstractions and permitted discharges located within 1km of the land required for the construction of the Proposed Scheme in the Annandale area.

Table 39: Surface water abstraction and permitted discharges in Water resources study area

Features	Details	Value
Licensed surface water abstractions	None	None
Registered private non-licensed surface water abstractions	None	None
Authorised discharges to surface water	Twelve, of which one is within the land required for the construction of the Proposed Scheme	Low

6.13.25 There is no obligation to register private water supplies, which comprise those for quantities less than $10m^3$ per day. Therefore, it has been assumed on a precautionary basis that unregistered surface water abstractions could exist within the study area. Any unregistered private surface water supplies present are considered high value receptors, until surveyed.

6.13.26 The number of abstractions and permitted discharges listed in the land quality assessment reported in this section may be different to that stated here, due to difference definitions of spatial scope. This is because the Water resources study area comprises all land within 1km of the land required for the construction of the Proposed Scheme, whereas the default land quality study area comprises all land within 250m of the land required for the construction of the Proposed Scheme. The default study areas may be extended where the potential for pathways to more remote receptors exists.

Groundwater

6.13.27 The location of abstractions, geological formations and indicative groundwater levels, where available, are shown in Map Series WR-02, in Volume 4, Water resources and flood risk Map Book.

6.13.28 The geology of the study area, including distribution and formation description, is described in the land quality section. The aquifer classification, WFD status and receptor value of the superficial and bedrock hydrogeology is summarised in Table 40 (for superficial deposits) and Table 41 (for bedrock). Unless stated otherwise, the geological groups listed will all be crossed by the Proposed Scheme. The current overall status of, and objective for, the WFD groundwater body is as stated in the current river basin management plan (RBMP). Where SEPA has not assigned an individual water body ID to a unit, it has been assumed that it is connected to the underlying water body.

Table 40: Summary of geology and hydrogeology in the study area – superficial deposits

Geology	Aquifer classification[224]	WFD body (ID) and current overall status	WFD status objective	Receptor value
Peat	Not a significant aquifer	None given by SEPA	None given by SEPA	Low
Alluvium	Moderate to high productivity	None given by SEPA	None given by SEPA	Moderate
Kilblane Sand and Gravel Formation	High productivity	None given by SEPA	None given by SEPA	High
Plumpe Farm Sand Member, Plumpe Sand and Gravel Formation	High productivity	None given by SEPA	None given by SEPA	High
River terrace deposits (Undifferentiated)	Moderate to high productivity	None given by SEPA	None given by SEPA	Moderate
Kerr Moraine Formation	Not a significant aquifer	None given by SEPA	None given by SEPA	Low
Gretna Till Formation	Not a significant aquifer	None given by SEPA	None given by SEPA	Low

Table 41: Summary of geology and hydrogeology in the study area – bedrock

Geology	Aquifer classification[224]	WFD body (ID) and current overall status	WFD status objective	Receptor value
Sherwood Sandstone Group – Chester Formation – St Bees Sandstone Member	High productivity	Annan (150623) Good	Good by 2015	High

Superficial deposit aquifers

6.13.29 The basis of the receptor values attributed to the superficial deposit aquifers present within the study area, as shown in Table 40, is outlined briefly as follows:

- Kilbane Sand and Gravel and Plumpe Sand and Gravel Formation (Plumpe Farm Sand Member) are classified as high productivity aquifers. They may be capable of supporting water supplies and may also form an important source of baseflow to rivers. They have therefore, been classified as high value receptors;
- alluvium and river terrace deposits (Undifferentiated) are classified as moderate to high productivity aquifers. They may be capable of supporting water supplies at a local rather than regional scale and may also form an important source of baseflow to rivers. They have therefore, been classified as moderate value receptors; and

[224] SEPA aquifer classification is used to assign a receptor value as follows:
High productivity = High value; Moderate to high productivity = Moderate value; and Not a significant aquifer = Low value.

- peat and Gretna Till Formation are classified as not a significant aquifer. They may supply baseflow to watercourses or store and yield limited amounts of groundwater and so have been classified as low value receptors.

Bedrock aquifers

6.13.30 The basis of the receptor values attributed to the bedrock aquifers present within the study area, as shown in Table 41, comprises the Sherwood Sandstone Group. The Sherwood Sandstone Group is represented locally by the St Bees Sandstone Member of the Chester Formation and has been classified as a high productivity aquifer by SEPA. This aquifer can also provide an important component of baseflow to rivers. It has, therefore, been assessed as a high value receptor.

WFD status of groundwater bodies

6.13.31 A summary of locations, current overall WFD status, and future overall status objectives associated with the designated superficial and bedrock groundwater bodies within the study area is provided in Table 40 and Table 41. The value attributed to each of these receptors is also indicated.

6.13.32 The superficial deposits in the study area are not formally designated as WFD groundwater bodies but may be hydraulically connected to the WFD bedrock aquifer.

Abstraction and permitted discharges (groundwater)

6.13.33 Table 42 sets out the groundwater abstraction and permitted discharges within 1km of the land required for the construction of the Proposed Scheme in the Annandale area.

Table 42: Groundwater abstraction and permitted discharges in Water resources study area

Feature	Details	Value
Groundwater Drinking Water Protected Area (DWPA) associated with licensed public water supplies (PWS)	The study area is located within the Annan DWPA (ground)[225]. On a precautionary basis, it is assumed that PWS boreholes are present in the region at locations which might be affected by the construction of the Proposed Scheme.	Very high
Private licensed groundwater abstractions	On a precautionary basis it is assumed that Lochinvar BH34 and BH35, Chapelknowe, Canonbie are used for potable water supply.	High
Registered unlicensed private groundwater abstractions	Well south of North Lodge for unknown purpose (assumed for potable supply).	High
	One at Watchhill for unknown purpose (assumed for potable supply).	High

[225] Bodies of water in the Solway Tweed river basin district that are used for the abstraction of drinking water. These bodies either provide more than 10m^3 per day of drinking water or serve more than 50 persons or are intended for such use.

Feature	Details	Value
Consented discharges to groundwater	Twenty, of which one is adjacent to the land required for the construction of the Proposed Scheme.	Low

Groundwater – surface water interactions

6.13.34 A desk-based assessment using Ordnance Survey maps identified 16 features within the study area that had potential to be a spring or sink. Further details on these features can be found in BID WR-004-OR003. Access was not possible to inspect any of these features. Therefore, these features are assumed to be high value receptors on a precautionary basis, pending site inspection. Three of these features are within, or adjacent to, the land required for the construction of the Proposed Scheme.

6.13.35 There are no ponds within the land required for the construction of the Proposed Scheme.

Water dependent habitats

6.13.36 The following five non-statutory designated nature conservation sites within the study area are potentially groundwater dependent and could be affected by the Proposed Scheme:

- Blacksike Wood and Bensmoor ancient woodland located adjacent to land required for the construction of the Proposed Scheme along the existing West Coast Main Line (WCML);
- three separate areas of ancient woodland known as Mossknowe Lodge Wood located adjacent to land required for the construction of the Proposed Scheme;
- unnamed ancient woodland east of Grahamshill Railway Cottages, located adjacent to land required for the construction of the Proposed Scheme along the existing WCML;
- Billy's Wood potential ancient woodland located immediately adjacent to the land required for the construction of the Proposed Scheme to the north of the existing WCML; and
- Kirkpatrick Burn Wood potential ancient woodland located 57m south of land required for the construction of the Proposed Scheme.

6.13.37 No designated nature conservation sites within the 1km study area that are dependent on surface water flows have the potential to be affected by the Proposed Scheme.

6.13.38 A more detailed description of the ecology of these sites is provided in the Section 6.5 Ecology and biodiversity assessment.

Future baseline

6.13.39 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2025. No committed developments of relevance for water resources in this area have been identified.

6.13.40 Volume 5: Appendix CT-004-OR003 provides details of the developments in the Annandale area that are assumed to have been implemented by 2038. No committed developments of relevance for water resources in this area have been identified.

Climate change

6.13.41 Detailed analysis of the potential impacts of climate change on the Proposed Scheme has been undertaken and is reported in Volume 3, Route-wide effects, Section 4. Although no definitive guidance is available, climate change may also affect future groundwater resources. However, any such changes are unlikely to alter the significance of the effects identified in this assessment.

Effects arising during construction

Avoidance and mitigation measures

Water resources

6.13.42 The principal strategy adopted to limit the temporary and permanent effects of the Proposed Scheme is through avoidance of sensitive receptors where reasonably practicable. Where receptors could not be avoided, mitigation measures have been incorporated where appropriate and reasonably practicable, to limit the potential effects. Section 16 of the draft Code of Construction Practice (CoCP)[226] includes a range of mitigation measures to reduce construction impacts insofar as reasonably practicable. The avoidance and mitigation measures that are of particular relevance to water resources during construction are described in this section of this report. Further specific mitigation to address effects in this area, are set out in the other mitigation section of this report.

6.13.43 The avoidance of sensitive receptors has reduced the risks associated with the Proposed Scheme not complying with the requirements of the WFD. Examples of this strategy include:

- avoidance, where reasonably practicable, of water dependent habitats, including natural springs that can play a key role in the hydrology and hydrogeology of such ecosystems; and
- avoidance, where reasonably practicable, of major PWS and smaller licensed and unlicensed abstractions of surface water and groundwater.

6.13.44 The presence of any unregistered private water supplies, their function and the means of protecting or, if necessary, replacing them would be discussed with any landowners potentially affected by the Proposed Scheme.

[226] Volume 5: Appendix CT-002-00000, *draft Code of Construction Practice (CoCP)*.

6.13.45 The temporary works shown on Map Series CT-05 in the Volume 4, Off-route effects Map Book have been informed by a detailed consideration of the water resources constraints and have sought to avoid sensitive features insofar as reasonably practicable.

6.13.46 Two watercourse realignments are proposed on Ewes Burn (two realignments: 800m in length (including 45m of culvert) and 180m in length). The realignments will be designed to have the equivalent hydraulic capacity to the existing channel, insofar as reasonably practicable. Where such watercourses are natural channels, appropriate design features will be incorporated to replicate and, where reasonably practicable, enhance their hydromorphological condition. The hydromorphological condition reflects the extent to which water flow, sediment composition and movement, continuity (in rivers) and the structure of physical habitats departs from that expected of a natural river or stream system. The design of these realignments will be developed in consultation with SEPA, with due consideration of WFD status objectives. The design of the Proposed Scheme will also ensure that field subsurface drainage systems can be adapted to discharge into the new channel.

6.13.47 Watercourse diversions, which would result in changes in flow regime within discrete sections of channel, have been avoided insofar as reasonably practicable. There are two diversions proposed within this study area at:

- Tributary of Ewes Burn 1 (400m in length including 45m of culvert – see Map Series CT-06-806); and
- Tributary of Ewes Burn 2 (150m in length including 85m of culvert – see Map Series CT-06-805).

6.13.48 For watercourses that are not in their natural condition, where reasonably practicable, the watercourse diversion design will incorporate measures to improve their hydromorphological condition. The design of these diversions will be developed in consultation with SEPA, with due consideration of WFD status objectives.

6.13.49 Infrastructure required within or in proximity to an existing channel (including bridge abutments, intermediate piers and outfalls) will be designed to reduce impacts on the natural hydromorphology of watercourse channels, insofar as reasonably practicable.

6.13.50 The draft CoCP includes requirements to protect water bodies and their associated water resources from the potential impacts of pollution from construction site runoff, including where appropriate:

- provision of maps showing sensitive areas and buffer zones where no pollutants are to be stored or used; and
- preparation of method statements for silt management, site drainage at compounds and satellite compounds, for the storage and control of oils and chemicals and the prevention of accidental spillages, in consultation with SEPA, and if appropriate, the Lead Local Flood Authority (LLFA) and other relevant authorities as part of the approvals process. These method statements will cover, where applicable:

- the avoidance of discharges of site runoff to watercourses, sewers or soakaways without the prior approval of the appropriate authority;
- measures to prevent silt-laden runoff and other pollutants entering the water environment; and
- restrictions or controls on excavation within watercourses to limit effects on water quality, sedimentation, fisheries and aquatic ecology.

6.13.51 Method statements will be required for all watercourse crossings and channel realignments required for site haul routes. The method statements will describe how potential changes to flood risk, water quality and channel hydromorphology will be managed during the establishment, use and decommissioning of all site haul routes.

6.13.52 Permanent culverts proposed on the smaller watercourse crossings within the study area include those on:

- Tributary of Ewes Burn 1 (45m long access road culvert); and
- Tributary of Ewes Burn 2 (32m long northern reception track culvert and 53m long stabling sidings culvert).

6.13.53 The design of these culverts will be developed in general accordance with Construction Industry Research and Information Association (CIRIA) and SEPA guidance and in consultation with SEPA specialists. The design has sought to mitigate the impact on the hydromorphology of the affected watercourse, as follows:

- drop inlet culverts and inverted siphons have been avoided;
- culvert lengths have been made as short as reasonably practicable; and
- invert levels will be set below the firm bed of the watercourse to allow a natural substrate to develop along the bed of the culvert.

6.13.54 The wider issues associated with these culverts and how, insofar as reasonably practicable, the design will ensure no deterioration in the status of any of the relevant water body's WFD quality elements, is considered within the Volume 5: Appendix WR-001-OR003 – WFD preliminary compliance assessment. Any mitigation required in response to significant ecological effects of these culverts is set out in the ecology and biodiversity assessment reported in this section.

6.13.55 Existing groundwater abstraction boreholes or monitoring points will be protected from physical damage, insofar as reasonably practicable, including appropriate decommissioning of abandoned boreholes in order to remove potential pollution pathways. If boreholes are to be decommissioned and replaced with alternatives, the contractors will follow the latest industry standard. This principle will also be applicable to springs potentially affected by the Proposed Scheme, although additional measures may be required to mitigate temporary construction impacts. Wherever a spring is to be covered or displaced by design elements then additional mitigation measures may be applied to relocate the spring, where reasonably practicable.

6.13.56 Measures will be introduced, as required, to mitigate the temporary and permanent effects on groundwater flows and water quality during excavation and construction of foundations and cuttings insofar as reasonably practicable. The types of measure that could be adopted include:

- installation of cut-off structures (impermeable barriers preventing water flow) around excavations;
- ensuring cut-off structures are driven to sufficient depths to meet an underlying strata or zone of lower permeability;
- promoting groundwater recharge, such as discharging pumped water to recharge trenches around excavations to maintain baseline groundwater and surface water conditions; and
- incorporating passive bypasses within the design, which could comprise a 'blanket' of permeable material, such as gravel, placed around temporary structures allowing groundwater to bypass the below-ground works, without a rise in groundwater levels on the upstream side.

6.13.57 The exact requirements will be refined and a method of mitigation will be designed following ground investigation at the cutting location where appropriate.

6.13.58 For major utilities, the following specific measures are considered in addition to the above points:

- trenchless crossing techniques will be used wherever practicable for sensitive watercourses and key designations to reduce the impact on these features;
- where temporary watercourse realignments or diversions are required, during reinstatement the watercourse will be returned to its natural course and condition after work is complete, insofar as reasonably practicable, with due consideration to its WFD status objectives; and
- hard bank reinforcement will be avoided at watercourse crossings insofar as reasonably practicable.

Flood risk

6.13.59 The avoidance and mitigation set out below will, insofar as reasonably practicable, mitigate permanent impact on flood risk and land drainage, therefore flood risk has been scoped out:

- provision has been made to pass surface water runoff and land drainage flows beneath sections of raised embankment that will cross surface water flow paths insofar as reasonably practicable. This will be achieved using perimeter drainage and culverts, with their inverts set below the likely level of any upstream field subsurface drainage systems;
- in locations where the Proposed Scheme will cross watercourses, the structures will be designed to accommodate flood flows up to and including the 1 in 100 (1%) annual

probability flood, with an allowance for climate change based on guidance issued by SEPA[227];

- runoff from the footprint of the infrastructure could occur more rapidly post-construction due to steeper slope angles and the permeability (or compacted nature) of the newly-created surfaces. The drainage systems will be designed to ensure that there will be no significant increases in flood risk, during storms up to and including the 1 in 100 (1%) annual probability design event, with an allowance for climate change based on the guidance issued by SEPA;
- balancing ponds for new sections of highway and railway drainage have been sized on a precautionary basis, pending more detailed information about the permeability and runoff characteristics of existing and proposed ground surfaces;
- where the Proposed Scheme will pass in cutting, drainage measures will be provided to limit overland flow into the cutting. This overland flow along with seepage and runoff from the cuttings will, where reasonably practicable, be drained to the catchments to which this water would naturally drain, avoiding transfer of water from one water body to another, which could increase flood risk or impact on land drainage systems; and
- measures will be introduced to reduce any potentially significant effects on groundwater flood risk insofar as reasonably practicable, including the incorporation of passive hydraulic bypasses at cuttings and other below-ground structures. These could for example comprise a 'blanket' of permeable material such as gravel.

6.13.60 The nominated undertaker will, insofar as reasonably practicable, ensure that flood risk is managed throughout the construction period and will consider flooding issues when planning sites and storing materials. If necessary, temporary provision will be made to reduce the potential for impacts on existing land drainage systems during construction. Some of the specific measures referred to in the draft CoCP, include:

- having regard to the requirement for construction activities to avoid any increases in flood risk to vulnerable receptors;
- preparation of flood risk assessments and method statements for temporary works, including main compound and satellite compound drainage, watercourse crossings and realignments and temporary realignments in consultation with the SEPA, and where applicable, the LLFA and other relevant regulators;
- location of storage, machinery, equipment and temporary buildings outside flood risk areas insofar as reasonably practicable;
- construction of outfalls during periods of low flow to reduce the risk of scour and erosion; and
- design of temporary watercourse realignments with equivalent hydraulic capacity to the existing channels, ensuring that field subsurface drainage systems can be adapted to discharge into the new channel.

[227] Scottish Environment Protection Agency (2019), *Climate change allowances for flood risk assessment in land use planning*, Available online at: https://www.sepa.org.uk/media/426913/lups_cc1.pdf.

6.13.61 In accordance with Section 16 of the draft CoCP, monitoring will also be undertaken in consultation with the SEPA, and where applicable, the LLFA. This is to ensure that temporary structures are installed, maintained and removed in accordance with the relevant environmental approvals and that any impacts on existing land drainage systems are managed appropriately.

6.13.62 For major utilities, the following specific measures are considered in addition to the above points:

- trenchless crossing techniques will be used wherever practicable for sensitive watercourses to reduce the impact of temporary watercourse diversions on flood risk; and
- hard bank reinforcement and piers in floodplains will be avoided at watercourse crossings where reasonably practicable.

Assessment of impacts and effects

6.13.63 This section describes the temporary and permanent significant effects on water resources and the WFD associated with the construction of the Proposed Scheme following the implementation of the avoidance and mitigation measures. The majority of the potential temporary impacts on the water environment during construction will be avoided or mitigated by the working methods outlined in the draft CoCP. The mitigation embedded into the design has focused on reducing permanent impacts resulting from the presence of the Proposed Scheme to as low a level as is reasonably practicable.

Surface water and the Water Framework Directive

6.13.64 Potential temporary impacts on surface water quality, due to site runoff and increased pollution risk, are a key concern during construction and have the potential to affect abstractions and the water environment more generally. However, the practices outlined in the draft CoCP are considered adequate to mitigate any temporary impacts, such that there are unlikely to be any significant effects.

6.13.65 Construction compounds may have substantial water demands that may require approval through the protective provisions in the hybrid Bill for abstractions to augment other supply options. The assessment will include location-specific engagement with SEPA and other water undertakers on the availability of water at that location. SEPA will be able to impose conditions on any abstractions approved, as part of the Controlled Activity Regulation (CAR) authorisation, so that no significant effects are likely to arise.

6.13.66 Two realignments of Ewes Burn are proposed and these realignments will have a permanent impact on the hydromorphology of the watercourse. This has been assessed as a minor impact on this high value receptor, leading to a moderate adverse effect, which is significant.

6.13.67 An approximately 400m long diversion, (which includes a 45m long culvert) of Tributary of Ewes Burn 1 will replace approximately 400m of existing channel (which includes an 8m long culvert). Similarly, a 150m diversion and two culverts (32m and 53m respectively) will replace

approximately 150m of existing channel on Tributary of Ewes Burn 2. The culverts make up approximately 10% of the respective watercourse lengths and will have a permanent impact on the hydromorphology of these watercourses. The diversions will be designed to incorporate measures, where reasonably practicable, to improve the hydromorphological conditions. These diversions and culverts have been assessed as minor impacts on these moderate value receptors, leading to permanent minor adverse effects, which are not significant. The preliminary WFD compliance assessment considers that these works would result in minor localised effects, with no adverse effect at the waterbody scale.

Groundwater and the Water Framework Directive

6.13.68 The southern reception tracks and headshunt will intercept the Gretna Till Formation (not a significant aquifer) which extends across much of the study area, and part of the limited area of alluvium (moderate to highly productive aquifer) present along a section of the southern reception tracks. These cuttings could therefore permanently reduce groundwater levels locally in these formations. This is assessed to be a minor impact on these low to moderate value receptors, leading to a minor adverse effect which is not significant.

6.13.69 The cuttings are not expected to extend into the Sherwood Sandstone Group bedrock aquifer. Any potential local changes in groundwater levels or groundwater quality in the aquifer are assessed as negligible, leading to a negligible effect which is not significant.

6.13.70 The southern reception tracks and headshunt cuttings will be located within the Annan DWPA (ground), indicating that very high value PWS boreholes may be located in the region. However, as these cuttings are not expected to extend into Sherwood Sandstone Group bedrock, the impact on groundwater quality in any PWS or other abstraction boreholes drawing on groundwater in the aquifer, is assessed to be negligible. This negligible impact would also give rise to a negligible adverse effect, which is not significant.

6.13.71 There is one CAR licence in the study area which is assumed to be a groundwater abstraction (Lochinvar BH34 and BH35, Chapelknowe, Canonbie), located approximately 845m east from the land required for the construction of the Proposed Scheme. Regardless of whether the abstraction at this location is from superficial deposits or the bedrock aquifer, the abstraction is located across hydraulic gradient from the Proposed Scheme. Therefore, the impact on the abstraction is assessed to be negligible, resulting in a negligible effect, which is not significant.

6.13.72 On a precautionary basis, it is assumed that other unregistered groundwater abstractions in the area could potentially be located close to the cuttings which form part of the southern reception tracks and headshunt (hereafter referred to as the southern reception track cutting and headshunt cutting). Any such abstractions are assumed to be high value receptors. A minor impact on groundwater flow and groundwater levels in the vicinity of any abstractions could, therefore, result in a permanent moderate adverse effect to these potential receptors, which would be significant.

6.13.73 The construction of the Proposed Scheme will require dewatering activities to take place, which will require approval under Protective Provisions in the Bill. The current assessment

covers the dewatering activities associated with cuttings. Engagement with SEPA will be undertaken in relation to each of the dewatering locations and activities, and SEPA will be able to impose conditions on any abstractions approved as part of the CAR authorisation, so that no significant effects are likely to arise.

Groundwater – surface water interactions

6.13.74 The cuttings containing the southern reception tracks and headshunt could lead to a reduction in baseflow to the upper reaches of Ewes Burn, Tributary of Ewes Burn 1 and Tributary of Ewes Burn 2, as groundwater may be intercepted by the cuttings and also by embankment piling. However, track drainage and land drainage will discharge into these watercourses thereby reducing the impact on flow. The impact of the Proposed Scheme on the flow in these watercourses is assessed to be negligible leading to a negligible effect, which is not significant.

6.13.75 The potential spring 200m south of Cranberry Farm is located beneath or very close to the proposed locations of the southern reception tracks, and Cranberry Farm accommodation overbridge for the Proposed Scheme at the source of the Ewes Burn, and therefore the spring could be lost. Until the nature of this feature has been confirmed by a site survey, it has been assumed to be a high value receptor, on a precautionary basis. The assessment, therefore, identifies the loss of this feature as resulting in a permanent major impact, leading to a permanent major adverse effect, which is significant.

6.13.76 The two potential springs 220m west and 300m north-west of Redhall Castle are located more than 300m from the land required for the construction of the Proposed Scheme. However, as the Redhall Castle area is downgradient of the headshunt cutting, the cutting might intercept some of the groundwater flow that would otherwise have supported flow in these potential springs. There is potential for a permanent reduction in flow due to the cutting intercepting groundwater flow to these features. Until the nature of the features has been confirmed by a site survey, they have been assumed to be high value receptors, on a precautionary basis. The impact on these discharges is assessed to be minor, leading to moderate adverse effects on these potential springs, which is significant.

Water dependent habitats

6.13.77 It has not been possible to undertake site surveys to understand the groundwater dependency of these habitats. In the absence of site surveys, on a precautionary basis details of the potential hydrological impacts beneath these habitats are assessed as follows:

- the southern reception tracks cutting could intercept some groundwater flow towards the south-west corner of Blacksike Wood ancient woodland as well as the uppermost reach of a drain in Blacksike Wood ancient woodland. The woodland and drain are located on the edge of the calculated radius of influence from the cutting but on a precautionary basis, this is assessed to be a permanent minor adverse impact on the groundwater levels at the site, due to the cutting drainage;

- the cutting containing the headshunt is likely to intercept groundwater flow towards the three separate parcels of ancient woodlands Mossknowe Lodge Wood, which are located in proximity to each other. On a precautionary basis the cutting drainage is assessed to have a permanent moderate adverse impact on groundwater levels at these sites;
- ancient woodland east of Grahamshill Railway Cottages, is located adjacent to land required for the construction of the Proposed Scheme along the existing WCML. The headshunt cutting could reduce groundwater levels beneath this ancient woodland. This is assessed to be permanent major adverse impact on groundwater levels at the site; and
- the headshunt cutting is likely to lead to a reduction in groundwater levels beneath Billy's Wood North, a potential ancient woodland, which is located close to land required for the construction of the Proposed Scheme along the existing WCML. This is assessed to be permanent moderate adverse impact on groundwater levels at the site.

6.13.78 The potential for these hydrological impacts to result in local ecological effects is assessed in Volume 5, Ecology register of local level effects, and for any significant effects, mitigation is identified in Section 6.5 Ecology and biodiversity assessment of this report.

Summary of likely significant effects

6.13.79 On a precautionary basis the Proposed Scheme is anticipated to result in the following significant effects that require other mitigation:

- a permanent moderate adverse effect on the hydromorphology of Ewes Burn as a result of two realignments to sections of the watercourse;
- a permanent moderate adverse effect on the hydromorphology of the Tributary of Ewes Burn 1 and Tributary of Ewes Burn 2, resulting from diversions and culverts on the watercourses;
- a permanent moderate adverse effect on any unregistered groundwater abstractions potentially located close to the cuttings required for the southern reception tracks and headshunt, due to drainage to these cuttings;
- a permanent major adverse effect on the potential spring 100m south of Cranberry Farm, as the feature is located beneath or very close to the cuttings required for the southern reception tracks and the embankments leading to the Cranberry Farm accommodation overbridge; and
- a permanent moderate adverse effect on one or both potential springs located 220m west and 300m north-west of Redhall Castle, as a result of a reduction in discharges due to the cutting required for the headshunt intercepting groundwater flow to these features.

Other mitigation measures

6.13.80 Additional mitigation measures have been developed to further reduce the temporary and permanent impacts of construction stage activities, where there is potential for the Proposed Scheme to result in significant effects.

Surface water and the Water Framework Directive

6.13.81 The mitigation proposed in the design of the two realignments on Ewes Burn (the first 800m long and the second 180m long) will be developed further in consultation with SEPA, to take into account requirements for the WFD, insofar as reasonably practicable. Consideration will be given to the use of in-channel enhancements and to introducing meanders to improve the channel morphology, compared to the current straightened watercourse, to ensure no adverse significant effects on hydromorphology.

6.13.82 Mitigation proposed in the design of the three culverts and two diversions on Tributary of Ewes Burn 1 and Tributary of Ewes Burn 2 will be developed further in consultation with SEPA, to take into account requirements for the WFD, insofar as reasonably practicable. Consideration will be given to the use of in-channel enhancements to ensure no adverse significant effects on channel morphology.

Groundwater

6.13.83 If, following engagement with SEPA and site surveys, it is confirmed that unregistered groundwater abstractions are present in or close to the southern reception tracks cutting and headshunt cutting, options to mitigate for potential impacts on groundwater flow and quality will be discussed with the abstraction owners and SEPA. Mitigation options will be considered with a view to ensuring a continuous, resilient water supply at abstraction sources from either the superficial deposits or the bedrock. Such mitigation options might include the lowering of pumps, deepening of abstraction sources, provision of alternative boreholes or alternative sources of water, to ensure no adverse significant effects on water users.

Groundwater – surface water interactions

6.13.84 Additional mitigation measures may be required for the management of groundwater baseflows to Ewes Burn and its tributaries due to temporary and permanent dewatering relating to the southern reception tracks cutting and headshunt cutting. Mitigation measures will be designed in detail following ground investigation and monitoring of surface water and groundwater levels. Mitigation could take the form of discharge of water intercepted by these cuttings to the Ewes Burn at an appropriate rate and location. This mitigation should also reduce the impact of the operational effects of the wastewater treatment works (WWTW) discharge (set out in the effects arising from operation section in the Water resources and flood risk assessment reported in this section). Any such additional measures will be designed in consultation with SEPA, to ensure no adverse significant effects on watercourse flow.

6.13.85 Surveys of the potential spring 200m south of Cranberry Farm will be undertaken to determine the value of the feature. It is located beneath or very close to the southern reception tracks for the Proposed Scheme and the embankments leading to the Cranberry Farm accommodation overbridge at the source of the Ewes Burn. If the feature is established to be a spring, it may be possible to relocate the spring downstream, with a

culvert beneath the embankment, and to provide additional discharge from drainage for the southern reception tracks in the new spring location. Options for recreating the spring would be considered in detailed design, to ensure no adverse significant effects on spring flow.

6.13.86 If confirmed by surveys to be high value springs, monitoring of flow for the two potential springs 220m west and 300m north-west of Redhall Castle would be undertaken prior to, during and following construction of the Proposed Scheme to assess any impact due to drainage in the cutting required for the headshunt. However, if a reduction in flow is confirmed, it is unlikely that effective mitigation will be practicable, therefore a residual significant effect will remain.

Summary of likely residual significant effects

6.13.87 With the implementation of the other mitigation measures as described above, on a precautionary basis, subject to confirmation during design development, it is anticipated that significant residual effects will remain on the two potential springs 220m west and 300m north-west of Redhall Castle (permanent moderate adverse effect).

Cumulative effects

6.13.88 No significant cumulative temporary or permanent effects related to water resources or flood risk during construction are anticipated.

Effects arising from operation

Avoidance and mitigation measures

6.13.89 The principal issue of concern during operation of the Proposed Scheme is the potential for accidental spillages to occur that could result in the release of contaminants into the water environment. This issue has been assessed on a route-wide basis in Volume 3, Route-wide effects, Section 16, where the mitigation measures associated with this risk are described. A draft water resources and flood risk operation and maintenance plan is provided in Volume 5: Appendix WR-007-00000.

6.13.90 The design takes into account the policies in the National Planning Framework[228] and will ensure that the Proposed Scheme is safe from flooding without increasing flood risk elsewhere.

6.13.91 Sustainable drainage systems will be used where reasonably practicable. These will help to remove any suspended material within runoff from the Proposed Scheme through filtration, vegetative adsorption or settlement. The drainage systems proposed will aim to ensure that the quantity and quality of water draining from the Proposed Scheme during its operational phase will have a negligible impact on the water environment.

[228] Scottish Government (2010), *Scottish planning policy.* Available online at: https://www.gov.scot/publications/scottish-planning-policy/.

6.13.92 The WFD preliminary compliance assessment is provided in Volume 5: Appendix WR-001-OR003. This describes how the Proposed Scheme complies with the requirements of the WFD.

Assessment of impacts and effects

6.13.93 The proposed WWTW will continuously discharge treated effluent to the Ewes Burn. Although this discharge will be treated, it is likely to vary from baseline surface water quality (with potentially greater concentrations of nutrients such as phosphate, boron and faecal coliforms). This could have an impact on surface water quality in Ewes Burn. The flow in this area of the upper catchment of Ewes Burn is expected to be low. Therefore, there may be a limited dilution of the treated effluent in the watercourse, particularly in drier conditions. On a precautionary basis, this is assessed to be a moderate impact on this high value receptor, resulting in a moderate adverse effect, which is significant. In addition, if any unregistered surface water abstractions are located on Ewes Burn, then the water quality of the abstraction could be affected. This is also assessed as a moderate impact on a high value receptor, leading to a moderate adverse effect, which is significant.

6.13.94 The preliminary WFD compliance assessment considers that the proposed WWTW could potentially result in an adverse effect on water quality in within the Kirtle Water WFD water body.

6.13.95 There are considered to be no other significant adverse effects related to water resources arising from the operation of the Proposed Scheme.

Other mitigation measures

6.13.96 Additional mitigation measures will be required for the effects on water quality in Ewes Burn, and any unregistered abstraction from Ewes Burn, and on Kirtle Water WFD water body as a result of the discharge from the WWTW. Mitigation measures will be designed in detail following ground investigation and monitoring of surface water flows. Mitigation could take the form of:

- alternative discharge locations (such as sewers or larger watercourses);
- drainage to ground via wetlands; and
- dilution of discharges (such as discharge of land and track drainage intercepted by the southern reception tracks and headshunt to Ewes Burn).

6.13.97 This mitigation would also help to reduce any impact on flow in Ewes Burn (as set out under other mitigation measures in the section on effects arising during construction in the Water resources and flood risk assessment reported in this section). Until suitable mitigation has been included in the design, significant residual adverse effects are likely to remain for water quality on Tributary of Ewes Burn 1 and on the Kirtle Water WFD water body, due to the discharge from the WWTW. HS2 Ltd continues to review the design and mitigation in relation to water quality effects, and any changes will be brought forward during the passage of the Bill in Parliament.

6.13.98 There are considered to be no further measures required to mitigate adverse effects on surface water resources or groundwater resources.

Summary of likely residual significant effects

6.13.99 On a precautionary basis, subject to further study at the detailed design stage of the project, it is anticipated that significant residual effects will remain on surface water quality in Ewes Burn resulting from the WWTW discharge during operation of the Proposed Scheme.

Cumulative effects

6.13.100 This assessment has not identified any significant cumulative effects during operation of the Proposed Scheme related to water resources.

Monitoring

6.13.101 Volume 1, Introduction and methodology, Section 9 sets out the general approach to monitoring of water resources and flood risk during operation of the Proposed Scheme.

6.13.102 There are no area-specific requirements for monitoring water resources and flood risk during operation of the Proposed Scheme.

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