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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix AQ-001-0MA04

Air quality

MA04: Broomedge to Glazebrook

Air quality report

M51

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Department for Transport

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High Speed Two (HS2) Limited
Two Snowhill
Snow Hill Queensway
Birmingham B4 6GA

Telephone: 08081 434 434

General email enquiries: HS2enquiries@hs2.org.uk

Website: www.hs2.org.uk

A report prepared for High Speed Two (HS2) Limited:

ARUP+ ERM | FOSTER + PARTNERS | JACOBS
RAMBOLL | TYPSA | COSTAIN

MWJV
Mott MacDonald | WSP

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Contents

Tables

1 Introduction

1.1.1 The report is an appendix to the air quality assessment for the Proposed Scheme in relation to the Broomedge to Glazebrook area (MA04).

1.1.2 This appendix comprises:

- baseline air quality data;
- construction dust assessment; and
- assessment of road traffic emissions.

1.1.3 Maps referred to throughout this appendix are contained in the Volume 5, Air quality Map Book: map AQ-01-304.

1.1.4 Additional data used for the air quality assessment, including traffic data, are set out in Background Information and Data (BID) (BID AQ-002-0MA04)[1].

1.1.5 The assessment scope, key assumptions and limitations, and the methodology for determining significance of effects for air quality are set out in Volume 1, Introduction and methodology, Section 9 and the Environmental Impact Assessment Scope and Methodology Report (SMR) (see Volume 5: Appendix CT-001-00001).

1.1.6 The air quality standards relevant to this assessment are:

- 40µg/m^3 as an annual mean for nitrogen dioxide (NO_2) and fine particulate matter (PM_{10});
- 200µg/m^3 one-hour mean for NO_2 not to be exceeded more than 18 times a year (equivalent to the 99.8th percentile of the one-hour mean);
- 50µg/m^3 24-hour mean for PM_{10} not to be exceeded more than 35 times a year (equivalent to the 90.4th percentile of the 24-hour mean); and
- 25µg/m^3 as an annual mean for fine particulate matter ($PM_{2.5}$).

[1]High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data, Additional data used in the air quality assessment,* BID AQ-002-0MA04. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

2 Baseline air quality data

2.1 Existing air quality

Local authority review and assessment information

2.1.1 The Broomedge to Glazebrook area lies mainly within the administrative areas of Warrington Borough Council (WBC), Trafford Metropolitan Borough Council (TMBC) and Salford City Council (SCC). All councils review air quality throughout the area following the local air quality management (LAQM) regime from the Department for Environment, Food and Rural Affairs (Defra)[2].

2.1.2 There are two Air Quality Management Areas (AQMA) within the Broomedge to Glazebrook: the Greater Manchester Combined Authority AQMA and the Warrington AQMA No.1. The Greater Manchester Combined Authority AQMA covers a number of areas in Greater Manchester. The Warrington AQMA No.1 covers a 50m wide strip both sides of the M6, M62 and M56 corridors. Both were designated for exceedances of the annual mean NO_2 standard, in May 2016 and November 2001 respectively.

Local air quality monitoring data

2.1.3 Monitoring sites within the study area that are relevant for this assessment are shown in the accompanying map AQ-01-304. The following sections provide a summary of the recorded pollutant concentrations at these sites. Further details on monitoring data are presented in BID AQ-002-0MA04[1].

Continuous monitoring

2.1.4 There is one continuous air quality monitoring site within the Broomedge to Glazebrook area. This is a rural background NO_2 site in Glazebury. Measurements of NO_2 were within the air quality standard in 2018.

Diffusion tubes

2.1.5 The local authorities in this area undertake air quality monitoring with the use of passive diffusion tubes as part of their LAQM process. There are three diffusion tube sites within the Broomedge to Glazebrook area.

[2] 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.

2.1.6 HS2 Ltd has undertaken additional monitoring for the purpose of validating the air quality assessment at three locations in this area.

2.1.7 Measurements of NO_2 were within the air quality standard at five sites in 2018. At the WA111 site near the M6, NO_2 concentrations were above the air quality standard in 2018.

Background pollutant concentrations

2.1.8 Estimates of background air quality were obtained from the Defra maps[2]. Background pollutant concentrations are within the air quality standards throughout the study area. Table 1 presents the range of background pollutant concentrations within the Broomedge to Glazebrook area for the existing and future baseline.

2.1.9 Background pollutant concentrations for the operational year of 2038 have been taken from the Defra background maps for 2030, which is the latest available year of data. The 2030 background maps have been as representative of the future baseline conditions during operation of the Proposed Scheme.

Table 1: Range of background pollutant concentrations

Pollutant	Background concentrations (µg/m³)		
	2018	2025	2038
Annual mean NOx	14.8µg/m³ to 36.0µg/m³	10.9µg/m³ to 23.9µg/m³	9.6µg/m³ to 19.7µg/m³
Annual mean NO_2	11.2µg/m³ to 24.4µg/m³	8.4µg/m³ to 17.1µg/m³	7.5µg/m³ to 14.4µg/m³
Annual mean PM_{10}	10.4µg/m³ to 15.2µg/m³	9.5µg/m³ to 14.2µg/m³	9.5µg/m³ to 14.1µg/m³
Annual mean $PM_{2.5}$	6.9µg/m³ to 9.2µg/m³	6.2µg/m³ to 8.5µg/m³	6.2µg/m³ to 8.5µg/m³

3 Construction dust assessment

3.1.1 This section provides details of the assessment of dust emissions during construction of the Proposed Scheme. Due to the linear nature of the Proposed Scheme and its associated dust generating activities, the construction dust assessment has been undertaken in detail for distinct assessment areas in the Broomedge to Glazebrook area.

3.2 Dust soiling and human health effects

Assessed receptors and sensitivity of the area

3.2.1 The assessment of dust soiling and human health effects has been undertaken for the following areas from south to north:

- area around Agden: there are no demolition activities in this area. Residential dwellings are located within 20m of earthworks, construction and trackout[3] activities;
- area around Heatley: residential dwellings are located within 20m of demolition, earthworks, construction and trackout activities;
- area around Warburton (south): there are no demolition activities in this area. Residential dwellings are located within 20m of earthworks, construction and trackout activities;
- area around Warburton (north): there are no demolition activities in this area. Residential dwellings are located within 20m of earthworks, construction and trackout activities;
- area around Cadishead: there are no demolition activities in this area. Residential dwellings are located within 20m of earthworks, construction and trackout activities; and
- area around Glazebrook: residential dwellings are located within 20m of demolition, earthworks, construction and trackout activities.

3.2.2 Table 2 presents the sensitivity of each area to dust soiling and human health effects.

Table 2: Sensitivity of area to dust soiling and human health effects

Effect	Demolition	Earthworks	Construction	Trackout
Area around Agden CP				
Dust soiling	Not applicable	High	High	Medium
Human health	Not applicable	Low	Low	Low
Area around Heatley				
Dust soiling	Medium	Medium	Medium	High
Human health	Low	Low	Low	Low
Area around Warburton (south)				
Dust soiling	Not applicable	High	High	Medium

[3] 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.

Effect	Demolition	Earthworks	Construction	Trackout
Human health	Not applicable	Low	Low	Low
Area around Warburton (north)				
Dust soiling	Not applicable	High	High	Medium
Human health	Not applicable	Medium	Medium	Low
Area around Cadishead				
Dust soiling	Not applicable	High	High	High
Human health	Not applicable	Medium	Medium	Low
Area around Glazebrook				
Dust soiling	Medium	High	High	High
Human health	Low	Low	Low	Low

Dust emission magnitude

3.2.3 Each dust generating activity has been assigned a dust emission magnitude as shown in Table 3.

Table 3: Dust emission magnitude for dust soiling and human health

Area	Demolition	Earthworks	Construction	Trackout
Area around Agden	Not applicable	Large	Large	Medium
Area around Heatley	Medium	Large	Large	Large
Area around Warburton (south)	Not applicable	Large	Large	Large
Area around Warburton (north)	Not applicable	Large	Large	Large
Area around Cadishead	Not applicable	Large	Large	Large
Area around Glazebrook	Medium	Large	Large	Large

Risk of impacts

3.2.4 Taking into consideration the dust emission magnitude of each activity and the sensitivity of each area, the risk of dust effects has been defined for each area as shown in Table 4.

Table 4: Risk of dust soiling and human health effects

Effect	Demolition	Earthworks	Construction	Trackout
Area around Agden				
Dust soiling	Not applicable	High risk	High risk	Low risk
Human health	Not applicable	Low risk	Low risk	Low risk
Area around Heatley				
Dust soiling	Medium risk	Medium risk	Medium risk	High risk
Human health	Low risk	Low risk	Low risk	Low risk
Area around Warburton (south)				
Dust soiling	Not applicable	High risk	High risk	Medium risk
Human health	Not applicable	Low risk	Low risk	Low risk

Effect	Demolition	Earthworks	Construction	Trackout
Area around Warburton (north)				
Dust soiling	Not applicable	High risk	High risk	Medium risk
Human health	Not applicable	Medium risk	Medium risk	Low risk
Area around Cadishead				
Dust soiling	Not applicable	High risk	High risk	High risk
Human health	Not applicable	Medium risk	Medium risk	Low risk
Area around Glazebrook				
Dust soiling	Medium risk	High risk	High risk	High risk
Human health	Low risk	Low risk	Low risk	Low risk

3.3 Ecological effects

Assessed receptors and sensitivity of the area

3.3.1 The assessment of ecological effects has been undertaken for the following areas from south to north:

- Fox Covert and Meadows Site of Biological Importance (SBI) is located within 20m of earthworks and construction activities. There are no demolition or trackout activities in this area;
- Coroners Wood Ancient Woodland (AW) is located within 20m of earthworks and construction activities. There are no demolition or trackout activities in this area; and
- Partington Nature Reserve SBI is located within 20m of trackout activities. There are no demolition earthworks or construction activities in this area; and

3.3.2 Table 5 presents the sensitivity of each area to ecological effects.

Table 5: Sensitivity of area to ecological effects

Area	Demolition	Earthworks	Construction	Trackout
Area around Fox Covert and Meadows SBI	Not applicable	Low	Low	Not applicable
Area around Coroners Wood AW	Not applicable	Low	Low	Not applicable
Area around Partington Nature Reserve SBI	Not applicable	Not applicable	Not applicable	Low

Dust emission magnitude

3.3.3 Each dust generating activity has been assigned a dust emission magnitude as shown in Table 6.

Table 6: Dust emission magnitude for ecological effects

Area	Demolition	Earthworks	Construction	Trackout
Fox Covert and Meadows SBI	Not applicable	Large	Large	Not applicable
Coroners Wood AW	Not applicable	Large	Large	Not applicable
Partington Nature Reserve SBI	Not applicable	Not applicable	Not applicable	Large

Risk of impacts

3.3.4 Taking into consideration the dust emission magnitude of each activity and the sensitivity of each area, the risk of dust effects has been defined for each area as shown in Table 7.

Table 7: Risk of ecological effects

Area	Demolition	Earthworks	Construction	Trackout
Fox Covert and Meadows SBI	Not applicable	Low risk	Low risk	Not applicable
Coroners Wood AW	Not applicable	Low risk	Low risk	Not applicable
Partington Nature Reserve SBI	Not applicable	Not applicable	Not applicable	Low risk

3.4 Summary of risks

3.4.1 The summary of risks identified within the Broomedge to Glazebrook area are shown in Table 8. As there are several construction locations in this area, a range of risks is shown which depends on the location of sensitive receptors and the magnitude of dust generating activities.

Table 8: Summary of risks for construction dust assessment

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

4 Assessment of road traffic emissions

4.1 Overall assessment approach

4.1.1 The air quality assessment for road traffic emissions has used the approach described in the SMR (see Volume 5: Appendix CT-001-00001). Pollutant concentrations have been predicted at sensitive human and ecological receptors where these are located within 200m of the affected road network. Where ecological sites have been assessed, the change in nitrogen (N) deposition has been predicted for comparison against the lower critical load for the site.

4.2 Model inputs and verification

Model parameters

4.2.1 The ADMS-Roads model was used to predict pollutant concentrations from changes in road traffic emissions. A surface roughness of 0.3m was used for this area and a surface roughness of 0.2m was used for the meteorological site. A minimum Monin-Obukhov length of 10m and latitude of 53 degrees were used in the assessment. Meteorological data from the Manchester Airport monitoring site was used for the year 2018.

Model verification

4.2.2 Verification was undertaken for the year 2018 comparing monitored and modelled NO_2 concentrations. The traffic data provided were assumed to be representative of 2018. The results of this comparison are shown in Table 9.

4.2.3 Model verification was undertaken where monitoring sites are located adjacent to the modelled road network. The objectives of the model verification are to evaluate model performance and to determine if model adjustment is required.

4.2.4 Some of the monitoring locations were not considered suitable for model verification, due to missing traffic or monitoring data or other spatial considerations. A total of 12 monitoring sites were included in the model verification exercise, spread across both the Broomedge to Glazebrook and MA05: Risley to Bamfurlong areas.

Table 9: Comparison of monitored and modelled NO_2 concentrations

Site	Monitored concentration (µg/m³)	Modelled concentration (µg/m³)	Difference [(modelled – monitored)/monitored]
MA04.01	32.0	22.8	-28.8%
MA04.03	21.6	17.8	-17.5%
MA05.03	25.2	19.4	-22.9%
MA05.04	28.3	20.7	-26.9%
MA05.05	30.5	25.4	-16.8%

Site	Monitored concentration (µg/m³)	Modelled concentration (µg/m³)	Difference [(modelled – monitored)/monitored]
MA05.06	40.4	36.1	-10.8%
MA05.07	32.3	26.3	-18.5%
MA05.09	35.9	32.3	-9.8%
MA05.10	45.0	54.9	21.7%
MA05.11	25.0	35.4	41.6%
MA05.12	21.3	20.3	-4.6%
MA05.13	33.9	51.4	51.6%

4.2.5 As around a third of the modelled NO_2 concentrations were greater than ±25% of the monitored concentrations model adjustment was undertaken.

4.2.6 The model overestimated NO_2 concentrations at three monitoring locations: MA05.10, MA05.11 and MA05.13, which are in the same area on Southworth Road near Lowton. At this location the M6 motorway is within approximately 80m of all three sites and approximately 8m higher than the monitoring points. The model setup assumes that the road and monitoring points are at the same level and this is likely to be the reason for the overestimation. Therefore, an adjustment factor of 0.6 was derived using the data from these monitoring sites. This adjustment factor has been applied to modelled concentrations at all receptors in locations at a similar difference in height and distance from a motorway.

4.2.7 The model underestimated NO_2 concentrations at the other monitoring locations and from those an adjustment factor of 1.4 was derived. This factor has been applied to model results for receptors in all other areas.

4.2.8 The adjusted modelled NO_2 concentrations are presented within Table 10. Modelled concentrations of PM_{10} and $PM_{2.5}$ have not been adjusted.

Table 10: Comparison of monitored and adjusted modelled NO_2 concentrations

Site	Monitored concentration (µg/m³)	Modelled adjusted concentration (µg/m³)	Difference [(modelled – monitored)/monitored]
MA04.01	32.0	26.6	-16.7%
MA04.03	21.6	20.2	-6.3%
MA05.03	25.2	21.8	-13.3%
MA05.04	28.3	23.9	-15.6%
MA05.05	30.5	29.9	-2.0%
MA05.06	40.4	42.5	5.2%
MA05.07	32.3	31.2	-3.4%
MA05.09	35.9	39.6	10.3%
MA05.10	45.0	40.5	-10.2%
MA05.11	25.0	27.5	9.8%
MA05.12	21.3	23.0	8.1%
MA05.13	33.9	38.1	12.4%

4.3 Assessment of construction traffic emissions

4.3.1 Construction traffic data used in this assessment detailed in BID (BID AQ-002-0MA04)[1]. The assessment of construction traffic emissions has used traffic data based on an estimate of the average daily flows in the peak year during the construction period (2025 – 2037). Vehicle emissions and background concentrations have been taken for the first construction year in 2025 as a worst case. Two construction scenarios have been assessed to capture peak construction traffic activity at different times in the construction period. It has been assumed that the changes in construction traffic will occur for the whole year. In some cases, this is a conservative approach, as the duration of the peak traffic flows may well be much shorter. These scenarios have been assessed against the relevant future baseline case without the Proposed Scheme.

4.3.2 Traffic data in the study area have been screened to identify roads that require further assessment and to confirm the likely effect of the change in emissions from vehicles using these roads during construction of the Proposed Scheme. The screening criteria are detailed in the SMR (see Volume 5: Appendix CT-001-00001) and are largely based on the Design Manual for Roads and Bridges (DMRB) thresholds for changes in annual average daily traffic (AADT), changes in daily heavy duty vehicle (HDV) flows and/or changes in road alignment by 5m or more.

4.3.3 Traffic data for construction vehicles using the site haul routes and moving between compounds have also been included in the assessment. Additional roads have been included in the assessment to account for their emissions at nearby receptors.

Receptors assessed and background concentrations

4.3.4 Sensitive receptors have been selected from the OS AddressBase Premium database. The receptors consist of residential properties, schools and care homes within 200m of the screened in roads and represent worst-case exposure locations. The location of all receptors is shown in accompanying map AQ-01-304.

4.3.5 One designated ecological receptor was identified within 200m of the screened in roads within the Broomedge to Glazebrook area during construction of the Proposed Scheme: the Woolston Eyes SSSI.

4.3.6 Details of the assessed receptors and the background concentrations used in the assessment are shown in Table 11 for human and Table 12 for ecological receptors.

Table 11: Modelled receptors and background concentrations (construction phase)

Receptor	Description/Location	Ordnance survey coordinates	Background concentrations in 2025 (µg/m³)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
04-C-H001	Burford Lane, Lymm	370523, 386054	11.6	8.9	9.7	6.3
04-C-H002	Weaste Lane, Warrington	366309, 386655	12.0	9.3	12.4	7.6
04-C-H003	Spring Lane, Lymm	371400, 387324	10.9	8.5	10.3	6.4
04-C-H004	Wet Gate Lane, Lymm	371245, 387670	10.9	8.5	10.3	6.4
04-C-H005	Paddock Lane, Warburton	370671, 389303	11.7	9.0	10.1	6.4
04-C-H006	Warburton Lane, Warburton	370991, 389376	11.7	9.0	10.1	6.4
04-C-H007	Warburton Lane, Warburton	371010, 389570	11.5	8.8	10.7	6.5
04-C-H008	Warburton Lane, Warburton	370984, 389887	11.7	9.0	10.1	6.4
04-C-H009	Nicol Avenue, Woolston	365664, 389894	16.7	12.4	12.5	8.0
04-C-H010	Manchester New Road, Partington	371688, 391470	13.9	10.5	11.3	7.4
04-C-H011	Glazebrook Lane, Glazebrook	369919, 391486	12.6	9.6	11.9	7.1
04-C-H012	Manchester New Road, Partington	371914, 391603	13.9	10.5	11.3	7.4
04-C-H013	Manchester Road, Carrington	373558, 392893	15.0	11.3	11.6	7.1
04-C-H014	M62, Irlam	372203, 395775	15.7	11.8	12.4	7.9

Table 12: Modelled ecological receptor backgrounds, APIS data and critical loads (construction phase)

Receptor	Sensitive habitat	2025 NOx background concentration (µg/m³)	APIS data[4] of average total N deposition (kg N/ha/yr)	Critical load (kg N/ha/yr)
Woolston Eyes SSSI	Deciduous woodland	12.6	38.9	10
	Lowland raised bog	12.6	22.8	10

Assessment results

4.3.7 Table 13 presents the predicted NO_2 impacts across all assessed scenarios for each assessed receptor. All impacts are predicted to be negligible for PM_{10} and $PM_{2.5}$. Table 14, Table 15 and Table 16 provide the summary of the modelled pollutant concentrations for the assessed receptors for the worst case construction traffic scenario. The magnitude of change and impact descriptor are also derived following the Institute of Air Quality Management (IAQM)/Environmental Protection UK (EPUK) methodology[5]. Table 17 and Table 18 provides the summary of the ecological receptors for the worst case construction traffic scenario assessment.

[4] Air Pollution Information System. Available online at: http://www.apis.ac.uk/.

Table 13: Comparison of impact descriptors across construction scenarios

Receptor	Impact descriptors for annual mean NO_2 concentrations	
	Scenario 1	Scenario 2
04-C-H001	Negligible	Negligible
04-C-H002	Negligible	Negligible
04-C-H003	Negligible	Negligible
04-C-H004	Negligible	Negligible
04-C-H005	Negligible	Moderate beneficial
04-C-H006	Negligible	Slight beneficial
04-C-H007	Negligible	Slight beneficial
04-C-H008	Negligible	Negligible
04-C-H009	Substantial adverse	Substantial adverse
04-C-H010	Negligible	Negligible
04-C-H011	Negligible	Negligible
04-C-H012	Negligible	Negligible
04-C-H013	Negligible	Negligible
04-C-H014	Negligible	Negligible

Table 14: Predicted annual mean NO_2 concentrations and impacts (construction phase)

Receptor	Description/Location	NO_2 concentrations (µg/m^3)		Change in NO_2 concentrations (µg/m^3)	Impact descriptor	Significance
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
04-C-H001	Burford Lane, Lymm	13.9	14.3	0.4	Negligible	Not significant
04-C-H002	Weaste Lane, Warrington	21.2	21.5	0.3	Negligible	Not significant
04-C-H003	Spring Lane, Lymm	8.9	9.0	0.1	Negligible	Not significant
04-C-H004	Wet Gate Lane, Lymm	9.0	9.1	0.1	Negligible	Not significant
04-C-H005	Paddock Lane, Warburton	18.3	18.7	0.4	Negligible	Not significant
04-C-H006	Warburton Lane, Warburton	16.0	16.4	0.4	Negligible	Not significant
04-C-H007	Warburton Lane, Warburton	18.0	18.5	0.5	Negligible	Not significant
04-C-H008	Warburton Lane, Warburton	16.8	17.4	0.6	Negligible	Not significant
04-C-H009	Nicol Avenue, Woolston	58.7	59.5	0.8	Substantial adverse	Significant
04-C-H010	Manchester New Road, Partington	17.1	17.4	0.3	Negligible	Not significant
04-C-H011	Glazebrook Lane, Glazebrook	12.1	12.3	0.2	Negligible	Not significant
04-C-H012	Manchester New Road, Partington	21.5	22.0	0.5	Negligible	Not significant
04-C-H013	Manchester Road, Carrington	18.1	18.4	0.3	Negligible	Not significant
04-C-H014	M62, Irlam	26.8	26.9	0.1	Negligible	Not significant

Table 15: Predicted annual mean PM_{10} concentrations and impacts (construction phase)

Receptor	Description/Location	PM_{10} concentrations (µg/m3)		Change in PM_{10} concentrations (µg/m3)	Impact descriptor	Significance
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
04-C-H001	Burford Lane, Lymm	10.5	10.5	< 0.1	Negligible	Not significant
04-C-H002	Weaste Lane, Warrington	16.4	16.5	0.1	Negligible	Not significant

Receptor	Description/Location	PM_{10} concentrations (µg/m3)		Change in PM_{10} concentrations (µg/m3)	Impact descriptor	Significance
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
04-C-H003	Spring Lane, Lymm	10.4	10.4	< 0.1	Negligible	Not significant
04-C-H004	Wet Gate Lane, Lymm	10.4	10.4	< 0.1	Negligible	Not significant
04-C-H005	Paddock Lane, Warburton	11.6	11.7	0.1	Negligible	Not significant
04-C-H006	Warburton Lane, Warburton	11.2	11.3	0.1	Negligible	Not significant
04-C-H007	Warburton Lane, Warburton	12.2	12.3	0.1	Negligible	Not significant
04-C-H008	Warburton Lane, Warburton	11.4	11.5	0.1	Negligible	Not significant
04-C-H009	Nicol Avenue, Woolston	20.6	20.8	0.2	Negligible	Not significant
04-C-H010	Manchester New Road, Partington	12.8	12.9	0.1	Negligible	Not significant
04-C-H011	Glazebrook Lane, Glazebrook	12.3	12.3	< 0.1	Negligible	Not significant
04-C-H012	Manchester New Road, Partington	14.0	14.2	0.2	Negligible	Not significant
04-C-H013	Manchester Road, Carrington	12.7	12.8	0.1	Negligible	Not significant
04-C-H014	M62, Irlam	14.9	14.9	< 0.1	Negligible	Not significant

Table 16: Predicted annual mean $PM_{2.5}$ concentrations and impacts (construction phase)

Receptor	Description/Location	$PM_{2.5}$ concentrations (µg/m3)		Change in $PM_{2.5}$ concentrations (µg/m3)	Impact descriptor	Significance
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
04-C-H001	Burford Lane, Lymm	6.7	6.8	0.1	Negligible	Not significant
04-C-H002	Weaste Lane, Warrington	10.0	10.1	0.1	Negligible	Not significant
04-C-H003	Spring Lane, Lymm	6.4	6.4	< 0.1	Negligible	Not significant
04-C-H004	Wet Gate Lane, Lymm	6.4	6.4	< 0.1	Negligible	Not significant
04-C-H005	Paddock Lane, Warburton	7.3	7.4	0.1	Negligible	Not significant
04-C-H006	Warburton Lane, Warburton	7.1	7.2	0.1	Negligible	Not significant
04-C-H007	Warburton Lane, Warburton	7.4	7.5	0.1	Negligible	Not significant
04-C-H008	Warburton Lane, Warburton	7.2	7.3	0.1	Negligible	Not significant
04-C-H009	Nicol Avenue, Woolston	13.0	13.1	0.1	Negligible	Not significant
04-C-H010	Manchester New Road, Partington	8.3	8.3	< 0.1	Negligible	Not significant
04-C-H011	Glazebrook Lane, Glazebrook	7.4	7.4	< 0.1	Negligible	Not significant
04-C-H012	Manchester New Road, Partington	8.9	9.0	0.1	Negligible	Not significant
04-C-H013	Manchester Road, Carrington	7.8	7.8	< 0.1	Negligible	Not significant
04-C-H014	M62, Irlam	9.5	9.5	< 0.1	Negligible	Not significant

Table 17: Predicted annual mean of NOx concentrations at ecological sites (construction phase)

Ecological site	Distance to road (m)	NOx concentrations (µg/m³)		Change in NOx concentrations (µg/m³)	Comparison against air quality standard (30µg/m³)
		2025 without the Proposed Scheme	2025 with the Proposed Scheme		
Woolston Eyes (East of M6)	10	48.6	49.3	0.7	Above standard
	20	39.5	40.1	0.6	Above standard
	30	34.5	34.9	0.4	Above standard
	40	31.2	31.6	0.4	Above standard
	50	28.8	29.2	0.4	Within standard
	75	25.1	25.3	0.2	Within standard
	100	22.8	23.0	0.2	Within standard
	150	20.1	20.3	0.2	Within standard
	200	18.6	18.7	0.1	Within standard
Woolston Eyes (West of M6)	10	44.3	45.0	0.7	Within standard
	20	36.5	37.0	0.5	Above standard
	30	32.1	32.5	0.4	Above standard
	40	29.2	29.6	0.4	Within standard
	50	27.2	27.5	0.3	Within standard
	75	23.9	24.2	0.3	Within standard
	100	22.0	22.2	0.2	Within standard
	150	19.7	19.8	0.1	Within standard
	200	18.4	18.5	0.1	Within standard

Table 18: Assessment of N deposition at ecological sites (construction phase)

Ecological site	Distance to road (m)	Dry deposition (kg N/ha/yr)		Change in N deposition (kg N/ha/yr)	Critical load (kg N/ha/yr)	Change in relation to lower critical load
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
Woolston Eyes (East of M6)	10	44.2	44.3	0.1	10	1.0%
	20	42.9	43.0	0.1	10	0.8%
	30	42.2	42.3	0.1	10	0.7%
	40	41.7	41.8	0.1	10	0.6%
	50	41.4	41.4	< 0.1	10	0.5%
	75	40.8	40.9	0.1	10	0.4%
	100	40.5	40.5	< 0.1	10	0.3%
	150	40.1	40.1	< 0.1	10	0.2%
	200	39.8	39.9	0.1	10	0.2%
Woolston Eyes (West of M6)	10	43.6	43.7	0.1	10	0.9%
	20	42.5	42.6	0.1	10	0.7%
	30	41.9	41.9	< 0.1	10	0.6%
	40	41.5	41.5	< 0.1	10	0.5%
	50	41.2	41.2	< 0.1	10	0.5%
	75	40.7	40.7	< 0.1	10	0.4%
	100	23.5	23.6	0.1	10	0.2%
	150	40.0	40.0	< 0.1	10	0.2%
	200	39.8	39.8	< 0.1	10	0.2%

4.3.8 The annual mean concentrations of NO_2 are predicted to be within the air quality standard at all but one (Nicol Avenue, Warrington) receptor with and without construction of the Proposed Scheme. Annual mean concentrations of PM_{10} and $PM_{2.5}$ are predicted to be within the air quality standards at all receptors, with and without construction of the Proposed Scheme.

4.3.9 At all receptors the annual mean NO_2 concentrations are predicted to be below 60µg/m^3. Therefore, the hourly mean standard is also expected to be met at these receptors. Similarly, since the annual mean PM_{10} concentrations are predicted to be below 35µg/m^3 at all receptors, the daily mean standard is also expected to be met.

4.3.10 Annual mean NOx concentrations at the Wolston Eyes SSSI are predicted to be above the air quality standard along all transects, both with and without construction of the Proposed Scheme. The change in N deposition due to the construction of the Proposed Scheme is predicted to be greater than 1% of the lowest critical load up to 10m east of the roadside, beyond which all other transect points are predicted to be less than 1% of the lowest critical load.

Assessment of significance

4.3.11 A significant adverse effect for NO_2 concentrations is anticipated at one human receptor at Nicol Avenue, Woolston. No significant effects are anticipated at any other receptor in relation to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations.

4.3.12 As the change in N deposition is predicted to be greater than 1% of the lower critical load, there is potential for significant effects at the Wolston Eyes SSSI and this is further assessed in Ecological register of local level effects, Volume 5: Appendix EC-015-0MA04.

4.4 Assessment of operational traffic emissions

Operational traffic model

4.4.1 For the assessment of traffic on the highway network, data for the year 2038 were used as the operational year of the Proposed Scheme.

Screening of traffic data

4.4.2 The screening process identified a total of nine roads in the Broomedge to Glazebrook area exceeding the DMRB thresholds for changes in AADT or daily HDV flows and/or changes in road alignment by 5m or more. These roads are:

- the A56 Higher Lane;
- Wet Gate Lane;
- Spring Lane;

- Damhead Lane;
- Dam Lane;
- the A6144 Bent Lane;
- the A6144 Warburton Lane;
- the B5160 Dunham Road; and
- Paddock Lane.

4.4.3 Further roads have been included in the assessment to account for their emissions at nearby receptors.

Receptors assessed and background concentrations

4.4.4 Sensitive receptors have been selected from the OS AddressBase Premium database. The receptors consist of residential properties, schools and care homes within 200m of the screened in roads and represent worst-case exposure locations (Table 19). The location of all receptors is shown on accompanying map AQ-01-304.

4.4.5 No designated ecological receptors were identified within 200m of the screened in roads within the Broomedge to Glazebrook area during operation of the Proposed Scheme.

4.4.6 Details of the assessed receptors and the background concentrations used in the assessment are shown in Table 19 for human receptors.

Table 19: Modelled human receptors and background concentrations (operational phase)

Receptor	Description/Location	Ordnance survey coordinates	Background concentrations in 2038 (µg/m^3)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
4-O-H001	Spring Lane, Lymm	371400, 387324	9.7	7.5	10.3	6.3
4-O-H002	Wet Gate Lane, Lymm	371245, 387670	9.7	7.5	10.3	6.3
4-O-H003	Bent Lane, Lymm	370456, 389279	10.3	8.0	10.0	6.4
4-O-H004	Paddock Lane, Lymm	370658, 389303	10.3	8.0	10.0	6.4
4-O-H005	Warburton Lane, Lymm	370950, 389310	10.3	8.0	10.0	6.4
4-O-H006	Paddock Lane, Lymm	370617, 389315	10.3	8.0	10.0	6.4
4-O-H007	Warburton Lane, Lymm	370459, 389345	10.3	8.0	10.0	6.4
4-O-H008	Paddock Lane, Lymm	370984, 389345	10.3	8.0	10.0	6.4
4-O-H009	School Lane, Hollinfare	371009, 389585	10.2	7.9	10.6	6.5
4-O-H010	St Helens Primary School, Hollinfare	369625, 390992	11.1	8.6	11.0	6.9
4-O-H011	Dam Lane	369748, 391136	11.1	8.5	11.8	7.1

Receptor	Description/Location	Ordnance survey coordinates	Background concentrations in 2038 (µg/m^3)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
4-O-H012	Bank Street, Glazebrook	369767, 391144	11.1	8.5	11.8	7.1
4-O-H013	Dam Lane, Hollinfare	369538, 391488	11.1	8.5	11.8	7.1
4-O-H014	Paddock Lane, Lymm	368969, 391806	11.1	8.5	14.1	8.5

Assessment results

4.4.7 Table 20, Table 21 and Table 22 provide the summary of the modelled pollutant concentrations for the assessed human receptors. The magnitude of change and impact descriptor are also derived following the IAQM/EPUK methodology[5].

[5] Institute of Air Quality Management (2017), *Land-Use Planning & Development Control: Planning for Air Quality.* Available online at: http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf.

Table 20: Predicted annual mean NO_2 concentrations and impacts (operation phase)

Receptor	Description/Location	NO_2 concentrations (µg/m³)		Change in NO_2 concentrations (µg/m³)	Impact descriptor	Significance
		2038 without the Proposed Scheme	2038 with the Proposed Scheme			
04-O-H001	Spring Lane, Lymm	7.5	7.5	< 0.1	Negligible	Not significant
04-O-H002	Wet Gate Lane, Lymm	7.5	7.5	< 0.1	Negligible	Not significant
04-O-H003	Bent Lane, Lymm	10.5	10.3	-0.2	Negligible	Not significant
04-O-H004	Paddock Lane, Lymm	11.8	8.3	-3.5	Slight beneficial	Not significant
04-O-H005	Warburton Lane, Lymm	9.8	8.8	-1.0	Negligible	Not significant
04-O-H006	Paddock Lane, Lymm	11.3	8.4	-2.9	Slight beneficial	Not significant
04-O-H007	Warburton Lane, Lymm	10.7	10.2	-0.5	Negligible	Not significant
04-O-H008	Paddock Lane, Lymm	9.9	9.2	-0.7	Negligible	Not significant
04-O-H009	School Lane, Hollinfare	11.2	9.9	-1.3	Negligible	Not significant
04-O-H010	St Helens Primary School, Hollinfare	8.9	8.9	< 0.1	Negligible	Not significant
04-O-H011	Dam Lane	9.8	9.9	0.1	Negligible	Not significant
04-O-H012	Bank Street, Glazebrook	10.4	10.6	0.2	Negligible	Not significant
04-O-H013	Dam Lane, Hollinfare	8.8	8.7	-0.1	Negligible	Not significant
04-O-H014	Paddock Lane, Lymm	8.7	8.6	-0.1	Negligible	Not significant

Table 21: Predicted annual mean PM_{10} concentrations and impacts (operation phase)

Receptor	Description/Location	PM_{10} concentrations (µg/m³)		Change in PM_{10} concentrations (µg/m³)	Impact descriptor	Significance
		2038 without the Proposed Scheme	2038 with the Proposed Scheme			
4-O-H001	Spring Lane, Lymm	10.3	10.3	< 0.1	Negligible	Not significant
4-O-H002	Wet Gate Lane, Lymm	10.3	10.3	< 0.1	Negligible	Not significant
4-O-H003	Bent Lane, Lymm	11.0	11.0	< 0.1	Negligible	Not significant

Receptor	Description/Location	PM_{10} concentrations ($\mu g/m^3$)		Change in PM_{10} concentrations ($\mu g/m^3$)	Impact descriptor	Significance
		2038 without the Proposed Scheme	2038 with the Proposed Scheme			
4-O-H004	Paddock Lane, Lymm	11.5	10.2	-1.3	Negligible	Not significant
4-O-H005	Warburton Lane, Lymm	10.7	10.3	-0.4	Negligible	Not significant
4-O-H006	Paddock Lane, Lymm	11.2	10.2	-1.0	Negligible	Not significant
4-O-H007	Warburton Lane, Lymm	11.0	10.8	-0.2	Negligible	Not significant
4-O-H008	Paddock Lane, Lymm	10.7	10.4	-0.3	Negligible	Not significant
4-O-H009	School Lane, Hollinfare	12.0	11.4	-0.6	Negligible	Not significant
4-O-H010	St Helens Primary School, Hollinfare	11.1	11.1	< 0.1	Negligible	Not significant
4-O-H011	Dam Lane	12.2	12.3	0.1	Negligible	Not significant
4-O-H012	Bank Street, Glazebrook	12.4	12.5	0.1	Negligible	Not significant
4-O-H013	Dam Lane, Hollinfare	11.9	11.9	< 0.1	Negligible	Not significant
4-O-H014	Paddock Lane, Lymm	14.1	14.1	< 0.1	Negligible	Not significant

Table 22: Predicted annual mean $PM_{2.5}$ concentrations and impacts (operation phase)

Receptor	Description/Location	$PM_{2.5}$ concentrations ($\mu g/m^3$)		Change in $PM_{2.5}$ concentrations ($\mu g/m^3$)	Impact descriptor	Significance
		2038 without the Proposed Scheme	2038 with the Proposed Scheme			
4-O-H001	Spring Lane, Lymm	6.3	6.3	< 0.1	Negligible	Not significant
4-O-H002	Wet Gate Lane, Lymm	6.3	6.3	< 0.1	Negligible	Not significant
4-O-H003	Bent Lane, Lymm	7.0	6.9	-0.1	Negligible	Not significant
4-O-H004	Paddock Lane, Lymm	7.3	6.5	-0.8	Negligible	Not significant
4-O-H005	Warburton Lane, Lymm	6.8	6.5	-0.3	Negligible	Not significant
4-O-H006	Paddock Lane, Lymm	7.1	6.5	-0.6	Negligible	Not significant
4-O-H007	Warburton Lane, Lymm	7.0	6.9	-0.1	Negligible	Not significant

Receptor	Description/Location	$PM_{2.5}$ concentrations ($\mu g/m^3$)		Change in $PM_{2.5}$ concentrations ($\mu g/m^3$)	Impact descriptor	Significance
		2038 without the Proposed Scheme	2038 with the Proposed Scheme			
4-O-H008	Paddock Lane, Lymm	6.8	6.6	-0.2	Negligible	Not significant
4-O-H009	School Lane, Hollinfare	7.2	6.9	-0.3	Negligible	Not significant
4-O-H010	St Helens Primary School, Hollinfare	6.9	6.9	< 0.1	Negligible	Not significant
4-O-H011	Dam Lane	7.3	7.3	< 0.1	Negligible	Not significant
4-O-H012	Bank Street, Glazebrook	7.4	7.5	0.1	Negligible	Not significant
4-O-H013	Dam Lane, Hollinfare	7.1	7.1	< 0.1	Negligible	Not significant
4-O-H014	Paddock Lane, Lymm	8.5	8.5	< 0.1	Negligible	Not significant

4.4.8 The annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are predicted to be within the air quality standards with and without the operation of the Proposed Scheme. Since the annual mean NO_2 concentrations are predicted to be below 60µg/m^3, the hourly mean standard is also expected to be met. Similarly, since the annual mean PM_{10} concentrations are predicted to be below 35µg/m^3, the daily mean standard is also expected to be met.

4.4.9 For annual mean NO_2 concentrations a slight beneficial impact is predicted at two human receptors on Paddock Lane in Lymm. Negligible impacts are predicted at all other human receptors in relation to annual mean NO_2 concentrations.

4.4.10 Negligible impacts are predicted at all human receptors for annual mean PM_{10} and $PM_{2.5}$ concentrations.

Assessment of significance

4.4.11 No significant effects are anticipated at any receptors in relation to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations.

hs2.org.uk

High Speed Two (HS2) Limited
Two Snowhill
Snow Hill Queensway
Birmingham B4 6GA
Freephone: 08081 434 434
Minicom: 08081 456 472
Email: HS2enquiries@hs2.org.uk