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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix AQ-001-0MA02

Air quality

MA02: Wimboldsley to Lostock Gralam

Air quality report

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Department for Transport

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1 Introduction

1.1.1 The report is an appendix to the air quality assessment for the Proposed Scheme in relation to the Wimboldsley to Lostock Gralam area (MA02).

1.1.2 This appendix comprises:

- baseline air quality data;
- construction dust assessment;
- mineral 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-01-302.

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-002-0MA02)[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-002-0MA02. 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 Cheshire West and Chester Council (CWCC) covers most of the Wimboldsley to Lostock Gralam area (MA02), with Cheshire East Council (CEC) lying on the southern edge of the area. 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 MA02: the Chester Road, Middlewich AQMA; and the Lewin Street, Middlewich AQMA. The Chester Road, Middlewich AQMA covers properties north and south of the A54 Chester Road in Middlewich and was declared in October 2017. The Lewin Street, Middlewich AQMA covers properties adjacent to a stretch of the A533 Lewin Street, south of Wych-House Lane, and was declared in November 2019. Both AQMA have been designated for exceedances of the annual mean NO_2 standard.

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-01-302. The following sections provide a summary of the recorded pollutant concentrations at these sites. Further details on monitoring data are presented in BID AQ-002-0MA02[1].

Diffusion tubes

2.1.4 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 16 diffusion tube sites within MA02. Of these, 13 tubes are located in Middlewich, near the A533 Lewin Street, A530 Newton Bank/Nantwich Road and A54 Chester Road/Kinderton Street, and three tubes are located near the M6 and the A530.

2.1.5 HS2 Ltd has undertaken additional monitoring for the purpose of verifying the air quality assessment at nine locations in this area.

[2] 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.

2.1.6 Measurements of NO_2 were within the air quality standard at most of the sites in 2018. Concentrations were above the air quality standard at three sites in 2018, two in Middlewich and one by the A556 near Rudheath.

Background pollutant concentrations

2.1.7 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 Wimboldsley to Lostock Gralam area for the existing and future baseline.

2.1.8 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 assumed to be 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	8.6µg/m³ to 21.7µg/m³	6.7µg/m³ to 14.0µg/m³	6.3µg/m³ to 12.7µg/m³
Annual mean NO_2	6.7µg/m³ to 16.0µg/m³	5.4µg/m³ to 10.7µg/m³	5.0µg/m³ to 9.7µg/m³
Annual mean PM_{10}	9.7µg/m³ to 13.0µg/m³	8.8µg/m³ to 12.0µg/m³	8.7µg/m³ to 12.0µg/m³
Annual mean $PM_{2.5}$	6.4µg/m³ to 8.8µg/m³	5.7µg/m³ to 8.0µg/m³	5.6µg/m³ to 7.8µg/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 Wimboldsley to Lostock Gralam 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 Wimboldsley: residential dwellings are located within 200m of demolition activities, and within 20m of earthworks, construction and trackout[3] activities;
- area around Stanthorne: residential dwellings are located within 200m of demolition activities and within 20m of earthworks, construction and trackout activities;
- area around Whatcroft: residential dwellings are located within 20m of demolition, earthworks, construction and trackout activities; and
- area around Lostock Gralam: residential dwellings are located within 50m of demolition activities, and within 20m of 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 Wimboldsley				
Dust soiling	Low	High	High	High
Human health	Low	Medium	Medium	Medium
Area around Stanthorne				
Dust soiling	Low	High	High	High
Human health	Low	Medium	Medium	Low
Area around Whatcroft				
Dust soiling	Medium	High	High	Medium
Human health	Low	Low	Low	Low
Area around Lostock Gralam				

[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
Dust soiling	Low	High	High	High
Human health	Low	Medium	Medium	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 Wimboldsley	Small	Large	Large	Large
Area around Stanthorne	Small	Large	Large	Large
Area around Whatcroft	Medium	Large	Large	Large
Area around Lostock Gralam	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 Wimboldsley				
Dust soiling	Negligible risk	High risk	High risk	High risk
Human health	Negligible risk	Medium risk	Medium risk	Medium risk
Area around Stanthorne				
Dust soiling	Negligible risk	High risk	High risk	High risk
Human health	Negligible risk	Medium risk	Medium risk	Low risk
Area around Whatcroft				
Dust soiling	Medium risk	High risk	High risk	Medium risk
Human health	Low risk	Low risk	Low risk	Low risk
Area around Lostock Gralam				
Dust soiling	Low risk	High risk	High risk	High risk
Human health	Low risk	Medium risk	Medium 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:

- area around Shropshire Union Canal (Middlewich Branch) Local Wildlife Site (LWS), Boundary Wood/Weaver Bank Wood LWS/Ancient Woodland (AW), Wimboldsley Wood Site of Special Scientific Interest (SSSI)/AW, Rookery/Small Rookery Woods LWS/AW: there are no demolition activities in the area. Ecological sites are located within 20m of earthworks, construction and trackout activities;
- area around Wimboldsley Woodland near Lea Hall LWS: there are no demolition or trackout activities in this area. The ecological site is located within 20m of earthworks and construction activities;
- area around River Dane LWS, Bostock Road Orchards 1 LWS, Dane Valley LWS, The Willowbeds LWS and Greenhays Farm Pasture LWS: Ecological sites are located within 20m of demolition, earthworks, construction and trackout activities;
- area around Bostock Orchards LWS, Veteran Ash LWS, Flint Mill Reedbeds LWS and Bull's Wood and Meadow LWS: there are no demolition activities in this area. Ecological sites are located within 20m of earthworks, construction and trackout activities;
- area around Trent and Mersey Canal LWS, Puddingdale Brook Wood 1 and 2 LWS, Whatcroft Hedge LWS and Whatcroft Lane Wetlands 1 and 2 LWS: there are no demolition activities in this area. Ecological sites are located within 20m of earthworks, construction and trackout activities;
- area around Ash Trees along Trent and Mersey Canal 1 and 2 LWS, Billinge Green LWS, Billinge Green Farm Pond Site of Biological Interest (SBI)/LWS, Pear Tree Farm LWS and Gad Brook Valley LWS: ecological sites are located within 50m of demolition activities and within 20m of earthworks, construction and trackout activities;
- area around Wade Brook LWS, Long Wood 1 and 2 LWS and Plumley Lime Beds SSSI: there are no demolition activities in this area. Ecological sites are located within 20m of earthworks, construction and trackout activities; and
- area around Winnington Belt AW, Mill Wood and Mill Bottoms LWS, Winnington Wood AW, Winnington and Peas Wood LWS and Leonards and Smoker Wood LWS: there are no demolition activities in this area. Ecological sites are located within 20m of earthworks, construction and trackout activities.

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 Shropshire Union Canal (Middlewich Branch) LWS, Boundary Wood/Weaver Bank Wood LWS/AW, Wimboldsley Wood SSSI/AW, Rookery/Small Rookery Woods LWS/AW.	Not applicable	Low	Low	Low
Area around Wimboldsley Woodland near Lea Hall LWS	Not applicable	Low	Low	Not applicable
Area around River Dane LWS, Bostock Road Orchards 1 LWS, Dane Valley LWS, the Willowbeds LWS and Greenhays Farm Pasture LWS.	Low	Low	Low	Low
Area around Bostock Orchards 2 LWS, Veteran Ash LWS, Flint Mill Reedbeds LWS and Bull's Wood and Meadow LWS.	Not applicable	Low	Low	Low
Area around Trent and Mersey Canal LWS, Puddingdale Brook Wood 1 and 2 LWS, Whatcroft Hedge LWS and Whatcroft Lane Wetlands 1 and 2 LWS.	Not applicable	Medium	Medium	Medium
Area around Ash Trees along Trent and Mersey Canal 1 and 2 LWS, Billinge Green LWS, Billinge Green Farm Pond SBI/LWS, Pear Tree Farm LWS and Gad Brook Valley LWS.	Low	Low	Low	Low
Area around Wade Brook LWS, Long Wood 1 and 2 LWS and Plumley Lime Beds SSSI.	Not applicable	Medium	Medium	Medium
Area around Winnington Belt AW, Mill Wood and Mill Bottoms LWS, Winnington Wood AW, Winnington and Peas Wood LWS and Leonards and Smoker Wood LWS.	Not applicable	Low	Low	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
Area around Shropshire Union Canal (Middlewich Branch) LWS, Boundary Wood/Weaver Bank Wood LWS/AW, Wimboldsley Wood SSSI/AW, Rookery/Small Rookery Woods LWS/AW.	Not applicable	Large	Large	Large
Area around Wimboldsley Woodland near Lea Hall LWS.	Not applicable	Large	Large	Not applicable
Area around River Dane LWS, Bostock Road Orchards 1 LWS, Dane Valley LWS, the	Small	Large	Large	Large

Area	Demolition	Earthworks	Construction	Trackout
Willowbeds LWS and Greenhays Farm Pasture LWS.				
Area around Bostock Orchards 2 LWS, Veteran Ash LWS, Flint Mill Reedbeds LWS and Bull's Wood and Meadow LWS.	Not applicable	Large	Large	Large
Area around Trent and Mersey Canal LWS, Puddingdale Brook Wood 1 and 2 LWS, Whatcroft Hedge LWS and Whatcroft Lane Wetlands 1 and 2 LWS.	Not applicable	Large	Large	Large
Area around Ash Trees along Trent and Mersey Canal 1 and 2 LWS, Billinge Green Farm Pond Site of Biological Interest (SBI)/LWS, Pear Tree Farm LWS and Gad Brook Valley LWS.	Medium	Large	Large	Large
Area around Wade Brook LWS, Long Wood 1 and 2 LWS and Plumley Lime Beds Site of Special Scientific Interest (SSSI).	Not applicable	Large	Large	Large
Area around Winnington Belt AW, Mill Wood and Mill Bottoms LWS, Winnington Wood AW, Winnington and Peas Wood LWS and Leonards and Smoker Wood LWS.	Not applicable	Large	Large	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
Area around Shropshire Union Canal (Middlewich Branch) LWS, Boundary Wood/Weaver Bank Wood LWS/AW, Wimboldsley Wood SSSI/AW, Rookery/Small Rookery Woods LWS/AW.	Not applicable	Low risk	Low risk	Low risk
Area around Wimboldsley Woodland near Lea Hall LWS.	Not applicable	Low risk	Low risk	Not applicable
Area around River Dane LWS, Bostock Road Orchards 1 LWS, Dane Valley LWS, the Willowbeds LWS and Greenhays Farm Pasture LWS.	Negligible risk	Low risk	Low risk	Low risk
Area around Bostock Orchards 2 LWS, Veteran Ash LWS, Flint Mill Reedbeds LWS and Bull's Wood and Meadow LWS.	Not applicable	Low risk	Low risk	Low risk
Area around Trent and Mersey Canal LWS, Puddingdale Brook Wood 1 and 2 LWS, Whatcroft Hedge LWS and Whatcroft Lane Wetlands 1 and 2 LWS.	Not applicable	Medium risk	Medium risk	Medium risk

Area	Demolition	Earthworks	Construction	Trackout
Area around Ash Trees along Trent and Mersey Canal 1 and 2 LWS, Billinge Green Farm Pond Site of Biological Interest (SBI)/LWS, Pear Tree Farm LWS and Gad Brook Valley LWS.	Low risk	Low risk	Low risk	Low risk
Area around Wade Brook LWS, Long Wood 1 and 2 LWS and Plumley Lime Beds Site of Special Scientific Interest (SSSI).	Not applicable	Medium risk	Medium risk	Medium risk
Area around Winnington Belt AW, Mill Wood and Mill Bottoms LWS, Winnington Wood AW, Winnington and Peas Wood LWS and Leonards and Smoker Wood LWS.	Not applicable	Low risk	Low risk	Low risk

3.4 Summary of risks

3.4.1 The summary of risks identified within the Wimboldsley to Lostock Gralam 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	Negligible to Medium	Negligible to Low	Negligible to Low
Earthworks	High	Low to Medium	Low to Medium
Construction	High	Low to Medium	Low to Medium
Trackout	Medium to High	Low to Medium	Low to Medium

4 Mineral dust assessment

4.1.1 This section provides details of the assessment of mineral dust emissions during construction of the Proposed Scheme due to the operation of borrow pits. The use of borrow pits is intended to reduce the need for longer distance transport and import of materials, therefore reducing the volume and impact of road traffic on local roads and communities.

4.1.2 There are four borrow pits in the Wimboldsley to Lostock Gralam area:

- Borrow Pit A;
- Borrow Pit B;
- Borrow Pit C; and
- Borrow Pit D.

4.2 Disamenity dust

4.2.1 All four borrow pits will be excavated for cohesive material, sands and gravels. These materials are classified as soft rock in the assessment. The predominant wind direction across these sites is south-westerly.

4.2.2 Borrow Pit A has an area of 136,000m^2. There are no ecological receptors within 250m of this site. There are 14 human receptors within 250m of this borrow pit:

- residential properties along Nantwich Road (centred on 368950, 363240), between 25m and 80m north of the borrow pit;
- a residential property on Nantwich Road (369095, 362963), 50m east of the borrow pit; and
- residential properties around Bellsmithy (centred on 369040, 362630), 40m south-east of the borrow pit.

4.2.3 Borrow Pit B has an area of 105,000m^2. There are no ecological receptors within 250m. There are 18 human receptors within 250m of this borrow pit, namely:

- Lea House Farm, Nantwich Road (368810, 364550), a residential receptor 50m east of the borrow pit;
- residential properties along Nantwich Road (368810, 364710), 200m north-east of the borrow pit; and
- School Cottages residential properties along Nantwich Road (368900, 363660), between 50m and 100m south of the borrow pit.

4.2.4 Borrow Pit C has an area of 112,000m^2. There are no ecological receptors within 250m of this site. There are 28 human receptors within 250m of this site, namely:

- Stanthorne Lodge, Middlewich Road (368620, 366660), a residential property 240m north-west of the borrow pit;
- residential properties along Birch Lane (368840, 366590), 100m north-east of the borrow pit;
- Mill Farm, Coalpit Lane, (367080, 369100), a residential property 230m east of the borrow pit; and
- residential properties along Coalpit Lane (368930, 366120), 120m east of the borrow pit.

4.2.5 Borrow Pit D has an area of 477,000m^2. There are no ecological receptors within 250m of this site. There are six human receptors within 250m of this site, namely:

- residential properties along King's Lane (373540, 370190), 40m north of the borrow pit; and
- residential properties near New Farm (373840, 369060), 70m south of the borrow pit.

Residual source emissions

4.2.6 The activities assessed for residual source emissions are: site preparation and restoration; mineral extraction; materials handling; on-site transportation; minerals processing; stockpiles and exposed surfaces; and off-site transportation. The residual source emissions can be classified as small, medium or large.

4.2.7 All borrow pits are estimated to have large residual source emissions for all activities, except for mineral processing, which has small residual source emissions. The overall residual source emissions for all borrow pits is therefore large.

Pathway effectiveness

4.2.8 To assess pathway effectiveness each receptor within the 250m distance band has been assessed separately, taking into account the frequency of winds likely to impact the receptor. Meteorological data from the past five years have been filtered to identify the percentage of time for dry days when the wind direction could carry dust from the borrow pit to the receptor. This value represents the frequency and has been classified as: infrequent, moderately frequent, frequent or very frequent using criteria classified by the Institute of Air Quality Management (IAQM) mineral dust guidance[4].

4.2.9 Meteorological data have been taken from Manchester Airport, which is located 20km north-east of the borrow pits in this area. Table 9 presents the details of this assessment.

[4] Institute of Air Quality Management (2016), *Guidance on the assessment of mineral dust impacts for planning.* Available online at: http://www.iaqm.co.uk/text/guidance/mineralsguidance_2016.pdf.

Table 9: Frequency of potentially dusty winds

Type of receptor	Receptor	Wind direction impacting receptor (degrees)	Yearly winds over 5m/s on dry days	Frequency of potentially dusty winds
Borrow pit A				
Residential	RA.01	150-270	22%	Very frequent
	RA.02	150-270	22%	Very frequent
	RA.03	150-270	22%	Very frequent
	RA.04	150-270	22%	Very frequent
	RA.05	150-270	22%	Very frequent
	RA.06	150-270	22%	Very frequent
	RA.07	150-270	22%	Very frequent
	RA.08	150-270	22%	Very frequent
	RA.09	150-270	22%	Very frequent
	RA.10	270-360	8%	Moderately frequent
Borrow pit B				
Residential	RB.01	180-240	14%	Frequent
	RB.02	180-240	14%	Frequent
	RB.03	210-240	6%	Moderately frequent
	RB.04	300-360	3%	Infrequent
	RB.05	300-360	3%	Infrequent
	RB.06	300-360	3%	Infrequent
	RB.07	300-360	3%	Infrequent
	RB.08	300-360	3%	Infrequent
	RB.09	300-360	3%	Infrequent
	RB.10	210-240	6%	Moderately frequent
Borrow pit C				
Residential	RC.01	210-300	17%	Frequent
	RC.02	180-240	14%	Frequent
	RC.03	180-240	14%	Frequent
	RC.04	180-240	14%	Frequent
	RC.05	180-240	14%	Frequent
	RC.06	180-240	14%	Frequent
	RC.07	210-300	17%	Frequent
	RC.08	180-240	14%	Frequent
	RC.09	180-240	14%	Frequent
	RC.10	210-300	17%	Frequent
Borrow pit D				
Residential	RD.01	150-300	28%	Very frequent
	RD.02	300-360	3%	Infrequent

Type of receptor	Receptor	Wind direction impacting receptor (degrees)	Yearly winds over 5m/s on dry days	Frequency of potentially dusty winds
	RD.03	150-300	28%	Very frequent
	RD.04	300-360	3%	Infrequent
	RD.05	150-300	28%	Very frequent
	RD.06	150-300	28%	Very frequent

4.2.10 For each receptor, their sensitivity was classified as high, medium or low. The distance of the receptor from the source was measured and the distance category was classified as: close (<100m), intermediate (100m – 200m) or distant (200m – 400m).

4.2.11 All human receptors are residential so are classified as high sensitivity. For each receptor, the frequency of potentially dusty winds and the distance category were used to classify the pathway effectiveness using the IAQM mineral guidance[4], as shown in Table 10.

Table 10: Receptor sensitivity, distance from source and pathway effectiveness

Type of receptor	Receptor	Frequency of potentially dusty winds	Distance category	Pathway effectiveness
Borrow pit A				
Residential	RA.01	Very frequent	Close	Highly effective
	RA.02	Very frequent	Close	Highly effective
	RA.03	Very frequent	Close	Highly effective
	RA.04	Very frequent	Close	Highly effective
	RA.05	Very frequent	Close	Highly effective
	RA.06	Very frequent	Close	Highly effective
	RA.07	Very frequent	Close	Highly effective
	RA.08	Very frequent	Close	Highly effective
	RA.09	Very frequent	Close	Highly effective
	RA.10	Moderately frequent	Close	Moderately effective
Borrow pit B				
Residential	RB.01	Frequent	Intermediate	Moderately effective
	RB.02	Frequent	Close	Highly effective
	RB.03	Moderately frequent	Intermediate	Moderately effective
	RB.04	Infrequent	Close	Ineffective
	RB.05	Infrequent	Close	Ineffective
	RB.06	Infrequent	Close	Ineffective
	RB.07	Infrequent	Close	Ineffective
	RB.08	Infrequent	Close	Ineffective
	RB.09	Infrequent	Close	Ineffective
	RB.10	Moderately frequent	Distant	Ineffective

Type of receptor	Receptor	Frequency of potentially dusty winds	Distance category	Pathway effectiveness
Borrow pit C				
Residential	RC.01	Frequent	Intermediate	Moderately effective
	RC.02	Frequent	Intermediate	Moderately effective
	RC.03	Frequent	Intermediate	Moderately effective
	RC.04	Frequent	Intermediate	Moderately effective
	RC.05	Frequent	Intermediate	Moderately effective
	RC.06	Frequent	Intermediate	Moderately effective
	RC.07	Frequent	Distant	Moderately effective
	RC.08	Frequent	Intermediate	Moderately effective
	RC.09	Frequent	Intermediate	Moderately effective
	RC.10	Frequent	Intermediate	Moderately effective
Borrow pit D				
Residential	RD.01	Very frequent	Close	Highly effective
	RD.02	Infrequent	Intermediate	Ineffective
	RD.03	Very frequent	Close	Highly effective
	RD.04	Infrequent	Intermediate	Ineffective
	RD.05	Very frequent	Close	Highly effective
	RD.06	Very frequent	Close	Highly effective

Risk of dust impacts

4.2.12 For each receptor, the residual source emissions and the pathway effectiveness were used to define the risk of dust impacts, as shown in Table 11.

Table 11: Risk of mineral dust impacts

Type of receptor	Receptor	Residual source emissions	Pathway effectiveness	Estimation of dust impact risk
Borrow pit A				
Residential	RA.01	Large	Highly effective	High risk
	RA.02	Large	Highly effective	High risk
	RA.03	Large	Highly effective	High risk
	RA.04	Large	Highly effective	High risk
	RA.05	Large	Highly effective	High risk
	RA.06	Large	Highly effective	High risk
	RA.07	Large	Highly effective	High risk
	RA.08	Large	Highly effective	High risk
	RA.09	Large	Highly effective	High risk
	RA.10	Large	Moderately effective	Medium risk

Type of receptor	Receptor	Residual source emissions	Pathway effectiveness	Estimation of dust impact risk
Borrow pit B				
Residential	RB.01	Large	Moderately effective	Medium risk
	RB.02	Large	Highly effective	High risk
	RB.03	Large	Moderately effective	Medium risk
	RB.04	Large	Ineffective	Low risk
	RB.05	Large	Ineffective	Low risk
	RB.06	Large	Ineffective	Low risk
	RB.07	Large	Ineffective	Low risk
	RB.08	Large	Ineffective	Low risk
	RB.09	Large	Ineffective	Low risk
	RB.10	Large	Ineffective	Low risk
Borrow pit C				
Residential	RC.01	Large	Moderately effective	Medium risk
	RC.02	Large	Moderately effective	Medium risk
	RC.03	Large	Moderately effective	Medium risk
	RC.04	Large	Moderately effective	Medium risk
	RC.05	Large	Moderately effective	Medium risk
	RC.06	Large	Moderately effective	Medium risk
	RC.07	Large	Moderately effective	Medium risk
	RC.08	Large	Moderately effective	Medium risk
	RC.09	Large	Moderately effective	Medium risk
	RC.10	Large	Moderately effective	Medium risk
Borrow pit D				
Residential	RD.01	Large	Highly effective	High risk
	RD.02	Large	Ineffective	Low risk
	RD.03	Large	Highly effective	High risk
	RD.04	Large	Ineffective	Low risk
	RD.05	Large	Highly effective	High risk
	RD.06	Large	Highly effective	High risk

Magnitude of dust impacts

4.2.13 For each receptor, the risk of dust impacts and the receptor sensitivity was used to define the magnitude of dust impacts, as shown in Table 12.

Table 12: Magnitude of dust impact

Type of receptor	Receptor	Receptor sensitivity	Estimation of dust impact risk	Magnitude of dust impact
Borrow A				
Residential	RA.01	High	High risk	Substantial adverse
	RA.02	High	High risk	Substantial adverse
	RA.03	High	High risk	Substantial adverse
	RA.04	High	High risk	Substantial adverse
	RA.05	High	High risk	Substantial adverse
	RA.06	High	High Risk	Substantial adverse
	RA.07	High	High Risk	Substantial adverse
	RA.08	High	High Risk	Substantial adverse
	RA.09	High	High Risk	Substantial adverse
	RA.10	High	Medium Risk	Moderate adverse
Borrow pit B				
Residential	RB.01	High	Medium risk	Moderate adverse
	RB.02	High	High risk	Substantial adverse
	RB.03	High	Medium risk	Moderate adverse
	RB.04	High	Low risk	Slight adverse
	RB.05	High	Low risk	Slight adverse
	RB.06	High	Low risk	Slight adverse
	RB.07	High	Low risk	Slight adverse
	RB.08	High	Low risk	Slight adverse
	RB.09	High	Low risk	Slight adverse
	RB.10	High	Low risk	Slight adverse
Borrow pit C				
Residential	RC.01	High	Medium risk	Moderate adverse
	RC.02	High	Medium risk	Moderate adverse
	RC.03	High	Medium risk	Moderate adverse
	RC.04	High	Medium risk	Moderate adverse
	RC.05	High	Medium risk	Moderate adverse
	RC.06	High	Medium risk	Moderate adverse
	RC.07	High	Medium risk	Moderate adverse
	RC.08	High	Medium risk	Moderate adverse
	RC.09	High	Medium risk	Moderate adverse
	RC.10	High	Medium risk	Moderate adverse
Borrow pit D				
Residential	RD.01	High	High risk	Substantial adverse
	RD.02	High	Low risk	Slight adverse
	RD.03	High	High risk	Substantial adverse

Type of receptor	Receptor	Receptor sensitivity	Estimation of dust impact risk	Magnitude of dust impact
	RD.04	High	Low risk	Slight adverse
	RD.05	High	High risk	Substantial adverse
	RD.06	High	High risk	Substantial adverse

4.3 Human health effects

4.3.1 To assess the impacts of borrow pits on human health, the background PM_{10} concentration for the centre of each borrow pit was obtained from the Defra background maps for 2025 and the number of sensitive receptors within 1km of the borrow pit were calculated. The background PM_{10} concentrations are all under 17µg/m^3 and therefore the effects on human health can be considered to be not significant.

5 Assessment of road traffic emissions

5.1 Overall assessment approach

5.1.1 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.

5.2 Model inputs and verification

Model parameters

5.2.1 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

5.2.2 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 13.

5.2.3 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.

5.2.4 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 18 monitoring sites were included in the model verification exercise, spread across both Hough to Walley's Green (MA01) and Wimboldsley to Lostock Gralam areas.

Table 13: Comparison of monitored and modelled NO_2 concentrations

Site	Monitored concentration (µg/m^3)	Modelled concentration (µg/m^3)	Difference [(modelled – monitored)/monitored]
MA01.1	28.0	13.5	-51.8%
MA01.2	38.8	23.6	-39.2%
MA01.3	31.5	18.5	-41.2%
MA01.8	34.3	19.8	-42.3%
MA01.9	32.7	21.9	-33.1%

Site	Monitored concentration (µg/m³)	Modelled concentration (µg/m³)	Difference [(modelled – monitored)/monitored]
MA01.15	34.9	18.9	-46.0%
MA01.18	32.6	16.6	-49.2%
MA02.19	28.2	16.5	-41.4%
MA02.20	35.6	23.4	-34.2%
MA02.21	48.5	37.2	-23.4%
MA02.22	25.4	17.2	-32.2%
MA02.23	35.1	16.2	-53.9%
MA02.33	31.2	19.5	-37.6%
MA02.35	36.7	18.7	-49.0%
MA02.41	32.0	22.2	-30.7%
MA02.42	38.0	20.6	-45.7%
MA02.43	31.7	21.0	-33.7%
MA02.44	21.3	23.9	12.0%

5.2.5 As nearly all of the modelled NO_2 concentrations were greater than ±25% of the monitored concentrations and there was systematic under prediction, model adjustment was undertaken. Three adjustment factors were calculated: a factor of 1.8 for locations covered by the Northwich transport model; a factor of 2.6 for locations covered by the Crewe and Winsford transport model; and a factor of 1.0 for locations near to the M6. Adjusted results are shown in Table 14. Modelled concentrations of PM_{10} and $PM_{2.5}$ have not been adjusted.

Table 14: Comparison of monitored and adjusted modelled NO_2 concentrations

Site	Monitored concentration (µg/m³)	Modelled adjusted concentration (µg/m³)	Difference [(modelled – monitored)/monitored]
MA01.1	28.0	20.1	-28.2%
MA01.2	38.8	44.8	15.6%
MA01.3	31.5	28.7	-8.8%
MA01.8	34.3	31.1	-9.2%
MA01.9	32.7	35.9	9.9%
MA01.15	34.9	29.6	-15.4%
MA01.18	32.6	24.8	-24.1%
MA02.19	28.2	21.6	-23.3%
MA02.20	35.6	33.0	-7.1%
MA02.21	48.5	54.2	11.8%
MA02.22	25.4	26.2	3.0%
MA02.23	35.1	27.6	-21.5%
MA02.33	31.2	33.5	7.3%
MA02.35	36.7	31.8	-13.5%
MA02.41	32.0	30.6	-4.5%
MA02.42	38.0	27.6	-27.3%

Site	Monitored concentration (µg/m³)	Modelled adjusted concentration (µg/m³)	Difference [(modelled – monitored)/monitored]
MA02.43	31.7	38.6	21.7%
MA02.44	21.3	23.9	12.0%

5.3 Assessment of construction traffic emissions

5.3.1 Construction traffic data used in this assessment is detailed in BID AQ-002-0MA02. The assessment of construction traffic emissions has used traffic data based on an estimate of the average maximum 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. Four 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.

5.3.2 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 vehicles (HDV) flows and/or changes in road alignment by 5m or more.

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

Receptors assessed and background concentrations

5.3.4 Sensitive receptors have been selected from the OS AddressBase Premium database. The receptors consist of residential properties, schools, hospitals and/or 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-01-302.

5.3.5 One designated ecological receptor, Wettenhall and Darnhall Wood SSSI was identified within 200m of the screened in roads within the Wimboldsley to Lostock Gralam area during construction of the Proposed Scheme.

5.3.6 Details of the assessed receptors and the background concentrations used in the assessment are shown in Table 15 for human and Table 16 for ecological receptors.

Table 15: Modelled receptors and background concentrations (construction phase)

Receptor	Description/Location	Ordnance survey coordinates	Background concentrations in 2025 (µg/m³)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
02-C-H001	Wimboldsley Primary School, A530 Nantwich Road, Wimboldsley	368937, 363622	8.6	6.7	9.5	6.0
02-C-H002	B5074 Swanlow Lane, Winsford	365146, 363858	7.3	5.8	8.9	5.8
02-C-H003	Booth Lane, Moston	372127, 364062	9.5	7.4	10.0	6.1
02-C-H004	Vauxhall Way, Winsford	364236, 364637	8.2	6.5	9.4	6.2
02-C-H005	Clive Green Lane, Stanthorne	368217, 365074	10.0	7.7	10.4	6.3
02-C-H006	Townfields Road, Winsford	364557, 365098	8.6	6.7	9.8	6.7
02-C-H007	Heritage Rise, Winsford	363205, 365586	7.7	6.1	9.6	6.3
02-C-H008	Clive Green Lane, Winsford	367335, 365747	8.5	6.7	9.8	6.1
02-C-H009	A54 High Street, Winsford	364117, 365997	8.6	6.7	9.8	6.7
02-C-H010	A54 Kinderton Street, Middlewich	370496, 366311	12.6	9.6	10.5	6.8
02-C-H011	Pinforld Lane, Middlewich	369887, 366349	9.9	7.7	10.0	6.5
02-C-H012	A54 Kinderton Street, Middlewich	370626, 366375	12.6	9.6	10.5	6.8
02-C-H013	Over Fair Close, Winsford	362742, 366414	6.7	5.3	9.5	6.0
02-C-H014	A54 Holmes Chapel Road, Middlewich	370766, 366448	12.6	9.6	10.5	6.8
02-C-H015	Middlewich Road, Stanthorne	368902, 366742	9.2	7.2	10.5	6.4
02-C-H016	A54 Holmes Chapel Road, Sproston	373937, 367027	9.3	7.3	10.1	6.2
02-C-H017	A553 Bostock Road, Bostock	368048, 367396	9.4	7.3	10.3	6.3
02-C-H018	Road One, Winsford	366788, 367574	11.7	9.0	10.5	7.1
02-C-H019	Bostock Road, Bostock	367375, 368410	9.1	7.1	9.4	6.1
02-C-H020	A530 King Street, Byley	369781, 368838	8.7	6.8	9.3	6.0
02-C-H021	A530 King street, Whatcroft	369444, 369855	8.5	6.7	9.7	6.1
02-C-H022	Davenham Road, Northwich	368645, 371484	9.3	7.2	9.2	6.0
02-C-H023	London Road, Northwich	365921, 371611	9.2	7.2	10.0	6.4
02-C-H024	B5082 Pennys Lane, Lach Dennis	369395, 372345	9.3	7.2	9.6	6.1
02-C-H025	Tudor Close, Rudheath	368463, 372714	10.6	8.2	10.1	6.4
02-C-H026	Land adjacent, A556, Birches Lane, Lostock Gralam	369524, 373547	9.6	7.5	10.4	6.4
02-C-H027	Birches Lane, Lostock Green	369412, 373809	9.6	7.5	10.4	6.4
02-C-H028	Birches Lane, Lostock Green	369201, 373956	9.6	7.5	10.4	6.4
02-C-H029	Hadfield Street, Northwich	366751, 374084	11.3	8.7	9.6	6.3
02-C-H030	Griffiths Road, Lostock Gralam	368637, 374720	11.1	8.5	9.7	6.3
02-C-H031	Ascol Drive, Plumley	370300, 375502	9.4	7.4	10.5	6.4
02-C-H032	Earles Lane, Wincham	368630, 376480	9.9	7.7	10.1	6.3
02-C-H033	A559 Marston Lane, Marston	367286, 376669	9.7	7.6	9.7	6.2
02-C-H034	Nantwich Road, Occleston Green	368809, 362397	9.2	7.2	9.2	5.9

Receptor	Description/Location	Ordnance survey coordinates	Background concentrations in 2025 (µg/m³)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
02-C-H035	Alder Way, Holmes Chapel	377099, 367540	9.2	7.2	9.3	6.0
02-C-H036	Byley Lane, Byley	372156, 369503	9.2	7.2	9.7	6.2
02-C-H037	Knutsford Road, Cranage	374616, 369917	10.8	8.4	11.4	7.0
02-C-H038	Middlewich Road, Allostock	373382, 371500	13.7	10.5	11.5	7.3

Table 16: Modelled ecological receptor backgrounds, APIS data and critical loads (construction phase)

Receptor	Sensitive habitat	2025 NOx background concentration (µg/m³)	APIS data[5] of average total N deposition (kg N/ha/yr)	Critical load (kg N/ha/yr)
Wettenhall and Darnhall Woods SSSI	Deciduous woodland	7.1	53.4	10

Assessment results

5.3.7 Table 17 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 18, Table 19 and Table 20 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[6]. Table 21 and Table 22 provide the summary of the ecological receptors for the worst case construction traffic scenario assessment.

Table 17: Comparison of impact descriptors across construction scenarios

Receptors	Impact descriptors for annual mean NO_2 concentrations			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
02-C-H001	Not applicable	Not applicable	Negligible	Negligible
02-C-H002	Not applicable	Not applicable	Slight adverse	Negligible
02-C-H003	Not applicable	Not applicable	Negligible	Negligible
02-C-H004	Not applicable	Not applicable	Slight adverse	Negligible
02-C-H005	Not applicable	Not applicable	Slight adverse	Moderate beneficial
02-C-H006	Not applicable	Not applicable	Not applicable	Not applicable
02-C-H007	Not applicable	Not applicable	Negligible	Negligible
02-C-H008	Not applicable	Not applicable	Negligible	Negligible

[5] Air Pollution Information System. Available online at: http://www.apis.ac.uk/.
[6] 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.

Receptors	Impact descriptors for annual mean NO_2 concentrations			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
02-C-H009	Not applicable	Not applicable	Negligible	Negligible
02-C-H010	Not applicable	Not applicable	Negligible	Slight adverse
02-C-H011	Not applicable	Not applicable	Slight beneficial	Slight adverse
02-C-H012	Not applicable	Not applicable	Negligible	Negligible
02-C-H013	Not applicable	Not applicable	Negligible	Negligible
02-C-H014	Not applicable	Not applicable	Negligible	Negligible
02-C-H015	Not applicable	Not applicable	Negligible	Negligible
02-C-H016	Not applicable	Not applicable	Negligible	Negligible
02-C-H017	Not applicable	Not applicable	Slight beneficial	Negligible
02-C-H018	Not applicable	Not applicable	Negligible	Negligible
02-C-H019	Not applicable	Not applicable	Not applicable	Not applicable
02-C-H020	Not applicable	Not applicable	Negligible	Negligible
02-C-H021	Not applicable	Not applicable	Negligible	Negligible
02-C-H022	Negligible	Negligible	Not applicable	Not applicable
02-C-H023	Negligible	Negligible	Not applicable	Not applicable
02-C-H024	Negligible	Negligible	Not applicable	Not applicable
02-C-H025	Negligible	Negligible	Not applicable	Not applicable
02-C-H026	Negligible	Negligible	Not applicable	Not applicable
02-C-H027	Negligible	Slight beneficial	Not applicable	Not applicable
02-C-H028	Negligible	Negligible	Not applicable	Not applicable
02-C-H029	Negligible	Not applicable	Not applicable	Not applicable
02-C-H030	Negligible	Not applicable	Not applicable	Not applicable
02-C-H031	Negligible	Negligible	Not applicable	Not applicable
02-C-H032	Negligible	Not applicable	Not applicable	Not applicable
02-C-H033	Negligible	Not applicable	Not applicable	Not applicable
02-C-H034	Not applicable	Not applicable	Negligible	Moderate beneficial
02-C-H035	Negligible	Negligible	Negligible	Negligible
02-C-H036	Negligible	Negligible	Negligible	Negligible
02-C-H037	Negligible	Negligible	Negligible	Negligible
02-C-H038	Negligible	Negligible	Negligible	Negligible

Table 18: Predicted annual mean NO2 concentrations and impacts (construction phase)

Receptor	Description/Location	NO_2 concentrations ($\mu g/m^3$)		Change in NO_2 concentrations ($\mu g/m^3$)	Impact descriptor	Significance
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
02-C-H001	Wimboldsley Primary School, A530 Nantwich Road, Wimboldsley	18.9	20.9	2.0	Negligible	Not significant
02-C-H002	B5074 Swanlow Lane, Winsford	16.8	20.3	3.5	Slight adverse	Not significant
02-C-H003	Booth Lane, Moston	12.7	12.9	0.2	Negligible	Not significant
02-C-H004	Vauxhall Way, Winsford	8.8	11.3	2.5	Slight adverse	Not significant
02-C-H005	Clive Green Lane, Stanthorne	15.2	17.5	2.3	Slight adverse	Not significant
02-C-H006	Townfields Road, Winsford	23.4	24.9	1.5	Negligible	Not significant
02-C-H007	Heritage Rise, Winsford	15.6	16.1	0.5	Negligible	Not significant
02-C-H008	Clive Green Lane, Winsford	13.3	15.3	2.0	Negligible	Not significant
02-C-H009	A54 High Street, Winsford	28.9	28.8	-0.1	Negligible	Not significant
02-C-H010	A54 Kinderton Street, Middlewich	29.4	31.2	1.8	Slight adverse	Not significant
02-C-H011	Pinforld Lane, Middlewich	30.0	32.0	2.0	Slight adverse	Not significant
02-C-H012	A54 Kinderton Street, Middlewich	23.9	25.5	1.6	Negligible	Not significant
02-C-H013	Over Fair Close, Winsford	16.4	17.4	1.0	Negligible	Not significant
02-C-H014	A54 Holmes Chapel Road, Middlewich	28.3	29.0	0.7	Negligible	Not significant
02-C-H015	Middlewich Road, Stanthorne	11.3	13.0	1.7	Negligible	Not significant
02-C-H016	A54 Holmes Chapel Road, Sproston	25.1	26.6	1.5	Negligible	Not significant
02-C-H017	A553 Bostock Road, Bostock	15.9	17.7	1.8	Negligible	Not significant
02-C-H018	Road One, Winsford	14.6	15.8	1.2	Negligible	Not significant
02-C-H019	Bostock Road, Bostock	11.1	12.4	1.3	Negligible	Not significant
02-C-H020	A530 King Street, Byley	26.3	26.6	0.3	Negligible	Not significant

Receptor	Description/Location	NO_2 concentrations ($\mu g/m^3$)		Change in NO_2 concentrations ($\mu g/m^3$)	Impact descriptor	Significance
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
02-C-H021	A530 King street, Whatcroft	26.0	26.4	0.4	Negligible	Not significant
02-C-H022	Davenham Road, Northwich	10.2	10.5	0.3	Negligible	Not significant
02-C-H023	London Road, Northwich	18.6	18.9	0.3	Negligible	Not significant
02-C-H024	B5082 Pennys Lane, Lach Dennis	11.3	12.4	1.1	Negligible	Not significant
02-C-H025	Tudor Close, Rudheath	27.9	28.1	0.2	Negligible	Not significant
02-C-H026	Land adjacent, A556, Birches Lane, Lostock Gralam	11.6	13.4	1.8	Negligible	Not significant
02-C-H027	Birches Lane, Lostock Green	15.9	16.9	1.0	Negligible	Not significant
02-C-H028	Birches Lane, Lostock Green	10.5	12.0	1.5	Negligible	Not significant
02-C-H029	Hadfield Street, Northwich	16.0	16.3	0.3	Negligible	Not significant
02-C-H030	Griffiths Road, Lostock Gralam	14.5	14.7	0.2	Negligible	Not significant
02-C-H031	Ascol Drive, Plumley	13.8	14.7	0.9	Negligible	Not significant
02-C-H032	Earles Lane, Wincham	16.3	17.2	0.9	Negligible	Not significant
02-C-H033	A559 Marston Lane, Marston	19.1	20.3	1.2	Negligible	Not significant
02-C-H034	Nantwich Road, Occleston Green	24.9	27.0	2.1	Negligible	Not significant
02-C-H035	Alder Way, Holmes Chapel	13.1	13.5	0.4	Negligible	Not significant
02-C-H036	Byley Lane, Byley	11.4	11.8	0.4	Negligible	Not significant
02-C-H037	Knutsford Road, Cranage	13.1	13.4	0.3	Negligible	Not significant
02-C-H038	Middlewich Road, Allostock	30.7	31.2	0.5	Negligible	Not significant

Table 19: Predicted annual mean PM_{10} concentrations and impacts (construction phase)

Receptor	Description/Location	PM_{10} concentrations ($\mu g/m^3$)		Change in PM_{10} concentrations ($\mu g/m^3$)	Impact descriptor	Significance
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
02-C-H001	Wimboldsley Primary School, A530 Nantwich Road, Wimboldsley	10.7	10.9	0.2	Negligible	Not significant
02-C-H002	B5074 Swanlow Lane, Winsford	10.0	10.4	0.4	Negligible	Not significant
02-C-H003	Booth Lane, Moston	10.5	10.5	< 0.1	Negligible	Not significant
02-C-H004	Vauxhall Way, Winsford	9.7	10.1	0.4	Negligible	Not significant
02-C-H005	Clive Green Lane, Stanthorne	11.1	11.3	0.2	Negligible	Not significant
02-C-H006	Townfields Road, Winsford	11.6	11.8	0.2	Negligible	Not significant
02-C-H007	Heritage Rise, Winsford	10.7	10.7	< 0.1	Negligible	Not significant
02-C-H008	Clive Green Lane, Winsford	10.5	10.7	0.2	Negligible	Not significant
02-C-H009	A54 High Street, Winsford	12.8	12.8	< 0.1	Negligible	Not significant
02-C-H010	A54 Kinderton Street, Middlewich	12.8	13.1	0.3	Negligible	Not significant
02-C-H011	Pinforld Lane, Middlewich	12.8	13.1	0.3	Negligible	Not significant
02-C-H012	A54 Kinderton Street, Middlewich	12.3	12.6	0.3	Negligible	Not significant
02-C-H013	Over Fair Close, Winsford	10.9	11	0.1	Negligible	Not significant
02-C-H014	A54 Holmes Chapel Road, Middlewich	13.2	13.4	0.2	Negligible	Not significant
02-C-H015	Middlewich Road, Stanthorne	10.9	11.1	0.2	Negligible	Not significant
02-C-H016	A54 Holmes Chapel Road, Sproston	11.9	12.2	0.3	Negligible	Not significant
02-C-H017	A553 Bostock Road, Bostock	11.2	11.4	0.2	Negligible	Not significant
02-C-H018	Road One, Winsford	11.3	11.5	0.2	Negligible	Not significant
02-C-H019	Bostock Road, Bostock	9.8	9.9	0.1	Negligible	Not significant
02-C-H020	A530 King Street, Byley	11.4	11.8	0.4	Negligible	Not significant
02-C-H021	A530 King street, Whatcroft	11.8	12.2	0.4	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
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
02-C-H022	Davenham Road, Northwich	9.6	9.6	< 0.1	Negligible	Not significant
02-C-H023	London Road, Northwich	11.8	11.9	0.1	Negligible	Not significant
02-C-H024	B5082 Pennys Lane, Lach Dennis	10.3	10.4	0.1	Negligible	Not significant
02-C-H025	Tudor Close, Rudheath	13.0	13.0	< 0.1	Negligible	Not significant
02-C-H026	Land adjacent, A556, Birches Lane, Lostock Gralam	10.9	11.2	0.3	Negligible	Not significant
02-C-H027	Birches Lane, Lostock Green	11.5	11.7	0.2	Negligible	Not significant
02-C-H028	Birches Lane, Lostock Green	10.8	11	0.2	Negligible	Not significant
02-C-H029	Hadfield Street, Northwich	10.7	10.8	0.1	Negligible	Not significant
02-C-H030	Griffiths Road, Lostock Gralam	10.7	10.8	0.1	Negligible	Not significant
02-C-H031	Ascol Drive, Plumley	11.4	11.6	0.2	Negligible	Not significant
02-C-H032	Earles Lane, Wincham	11.2	11.3	0.1	Negligible	Not significant
02-C-H033	A559 Marston Lane, Marston	11.4	11.5	0.1	Negligible	Not significant
02-C-H034	Nantwich Road, Occleston Green	11.1	11.6	0.5	Negligible	Not significant
02-C-H035	Alder Way, Holmes Chapel	10.4	10.4	< 0.1	Negligible	Not significant
02-C-H036	Byley Lane, Byley	10.4	10.7	0.3	Negligible	Not significant
02-C-H037	Knutsford Road, Cranage	12.2	12.3	0.1	Negligible	Not significant
02-C-H038	Middlewich Road, Allostock	14.8	14.9	0.1	Negligible	Not significant

Table 20: Predicted annual mean $PM_{2.5}$ concentrations and impacts (construction 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
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
02-C-H001	Wimboldsley Primary School, A530 Nantwich Road, Wimboldsley	6.7	6.9	0.2	Negligible	Not significant
02-C-H002	B5074 Swanlow Lane, Winsford	6.4	6.6	0.2	Negligible	Not significant
02-C-H003	Booth Lane, Moston	6.4	6.4	< 0.1	Negligible	Not significant
02-C-H004	Vauxhall Way, Winsford	6.4	6.6	0.2	Negligible	Not significant
02-C-H005	Clive Green Lane, Stanthorne	6.8	6.9	0.1	Negligible	Not significant
02-C-H006	Townfields Road, Winsford	7.7	7.8	0.1	Negligible	Not significant
02-C-H007	Heritage Rise, Winsford	6.9	6.9	< 0.1	Negligible	Not significant
02-C-H008	Clive Green Lane, Winsford	6.5	6.7	0.2	Negligible	Not significant
02-C-H009	A54 High Street, Winsford	8.3	8.3	< 0.1	Negligible	Not significant
02-C-H010	A54 Kinderton Street, Middlewich	8.1	8.3	0.2	Negligible	Not significant
02-C-H011	Pinfold Lane, Middlewich	8.1	8.2	0.1	Negligible	Not significant
02-C-H012	A54 Kinderton Street, Middlewich	7.8	8	0.2	Negligible	Not significant
02-C-H013	Over Fair Close, Winsford	6.7	6.8	0.1	Negligible	Not significant
02-C-H014	A54 Holmes Chapel Road, Middlewich	8.3	8.4	0.1	Negligible	Not significant
02-C-H015	Middlewich Road, Stanthorne	6.7	6.8	0.1	Negligible	Not significant
02-C-H016	A54 Holmes Chapel Road, Sproston	7.3	7.5	0.2	Negligible	Not significant
02-C-H017	A553 Bostock Road, Bostock	6.8	6.9	0.1	Negligible	Not significant
02-C-H018	Road One, Winsford	7.5	7.6	0.1	Negligible	Not significant
02-C-H019	Bostock Road, Bostock	6.3	6.4	0.1	Negligible	Not significant
02-C-H020	A530 King Street, Byley	7.2	7.4	0.2	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
		2025 without the Proposed Scheme	2025 with the Proposed Scheme			
02-C-H021	A530 King street, Whatcroft	7.3	7.5	0.2	Negligible	Not significant
02-C-H022	Davenham Road, Northwich	6	6.2	0.2	Negligible	Not significant
02-C-H023	London Road, Northwich	6.5	7.5	1.0	Negligible	Not significant
02-C-H024	B5082 Pennys Lane, Lach Dennis	6.1	6.5	0.4	Negligible	Not significant
02-C-H025	Tudor Close, Rudheath	6.5	8.1	1.6	Negligible	Not significant
02-C-H026	Land adjacent, A556, Birches Lane, Lostock Gralam	6.4	6.9	0.5	Negligible	Not significant
02-C-H027	Birches Lane, Lostock Green	6.4	7.2	0.8	Negligible	Not significant
02-C-H028	Birches Lane, Lostock Green	6.4	6.8	0.4	Negligible	Not significant
02-C-H029	Hadfield Street, Northwich	6.3	6.9	0.6	Negligible	Not significant
02-C-H030	Griffiths Road, Lostock Gralam	6.3	6.9	0.6	Negligible	Not significant
02-C-H031	Ascol Drive, Plumley	6.5	7.1	0.6	Negligible	Not significant
02-C-H032	Earles Lane, Wincham	6.3	7	0.7	Negligible	Not significant
02-C-H033	A559 Marston Lane, Marston	6.2	7.2	1.0	Negligible	Not significant
02-C-H034	Nantwich Road, Occleston Green	7	7.3	0.3	Negligible	Not significant
02-C-H035	Alder Way, Holmes Chapel	6.6	6.6	< 0.1	Negligible	Not significant
02-C-H036	Byley Lane, Byley	6.6	6.8	0.2	Negligible	Not significant
02-C-H037	Knutsford Road, Cranage	7.5	7.5	< 0.1	Negligible	Not significant
02-C-H038	Middlewich Road, Allostock	9.3	9.4	0.1	Negligible	Not significant

Table 21: 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		
Wettenhall and Darnhall Woods SSSI	79	9.3	10.0	0.7	Within standard
	80	9.3	9.9	0.7	Within standard
	100	9.0	9.5	0.5	Within standard
	150	8.6	8.9	0.4	Within standard

Table 22: 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			
Wettenhall and Darnhall Woods SSSI	79	53.8	53.9	0.1	10	1.1%
	80	53.7	53.8	< 0.1	10	1%
	100	53.7	53.8	< 0.1	10	0.9%
	150	53.6	53.7	0.1	10	0.6%

5.3.8 The annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are predicted to be within the air quality standards with and without construction of the Proposed Scheme at all the receptors assessed. 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.

5.3.9 For annual mean NO_2 concentrations, a slight adverse impact is predicted at five receptors in Middlewich, Winsford, on Clive Green Lane and the B5074 Swanlow Lane. Negligible impacts are predicted at all other modelled receptors for annual mean NO_2 concentrations. Negligible impacts are predicted at all residential receptors for annual mean PM_{10} and $PM_{2.5}$ concentrations.

5.3.10 Annual mean NOx concentrations at the Wettenhall and Darnhall Woods SSSI are predicted to be within the air quality standard. The change in N deposition due to the construction of the Proposed Scheme is predicted to be greater than 1% of the lower critical load for this site up to 80m from the roadside.

Assessment of significance

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

5.3.12 As the change in N deposition is predicted to be greater than 1% of the lower critical load at the Wettenhall and Darnhall Woods SSSI there is potential for significant effects and this is further assessed in Ecological register of local level effects, Volume 5: Appendix EC-015-0MA02.

5.4 Assessment of operational traffic emissions

Operational traffic model

5.4.1 Operational traffic data used in this assessment is detailed in BID (BID AQ-002-0MA02)[1]. For the assessment of traffic on the highway network, data for the year 2038 was used as the operational year of the Proposed Scheme.

Screening of traffic data

5.4.2 The screening process identified a total of 38 roads in the Wimboldsley to Lostock Gralam 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 include:

- the A54 Middlewich Road/St Michaels Way/Kinderton Street/Holmes Chapel Road/Chester Road;

- the A530 Nantwich Road/ Chester Road/King Street/ Griffiths Road;
- the A533 Bostock Road/ Dane Street/London Road/Kingsmead;
- the B5082 Holmes Chapel Road;
- the B5082 Penny's Lane;
- Birches Lane;
- Clive Lane; and
- Clive Green Lane.

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

Receptors assessed and background concentrations

5.4.4 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 23). The location of all receptors is shown on accompanying map AQ-01-302.

5.4.5 No designated ecological receptors were identified within 200m of the screened-in roads within the Wimboldsley to Lostock Gralam area during construction of the Proposed Scheme.

5.4.6 Details of the assessed receptors and the background concentrations used in the assessment are shown in Table 23 for human receptors.

Table 23: 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}	$PM_{2.5}$
2-O-H01	Nantwich Road, Occleston	368802, 362391	8.7	6.8	9.1	5.9
2-O-H02	Primary School, Occleston	368937, 363622	8.1	6.3	9.4	5.9
2-O-H03	Nantwich Road, Occleston	368809, 364705	8.1	6.4	10.5	6.2
2-O-H04	Clive Green Lane, Occleston	368217, 365074	9.4	7.3	10.3	6.3
2-O-H05	Clive Green Lane, Occleston	367834, 365142	8.0	6.3	9.8	6.1
2-O-H06	Nantwich Road, Occleston	369163, 365198	9.8	7.6	10.0	6.3
2-O-H07	Clive Green Lane, Winsford	367335, 365747	8.0	6.3	9.8	6.1
2-O-H08	Clive Green Lane, Winsford	367280, 365953	8.0	6.3	9.8	6.1
2-O-H09	Clive Green Lane, Winsford	367289, 366012	11.3	8.6	9.6	6.3

Receptor	Description/Location	Ordnance survey coordinates	Background concentrations in 2038 (µg/m^3)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
2-O-H10	Middlewich Road, Winsford	367749, 366003	11.3	8.6	9.6	6.3
2-O-H11	Middlewich Road, Winsford	367938, 366107	11.3	8.6	9.6	6.3
2-O-H12	Nursery, Winsford	367336, 366138	11.3	8.6	9.6	6.3
2-O-H13	Stanthorne Hall, Winsford	368186, 366549	8.6	6.7	10.4	6.4
2-O-H14	Middlewich Road, Middlewich	369197, 366771	9.2	7.2	9.9	6.4
2-O-H15	Bostock Road, Winsford	368350, 367107	8.8	6.9	10.2	6.3
2-O-H16	Holmes Chapel Road, Allostock	372948, 370997	10.5	8.1	11.2	7.8
2-O-H17	Holmes Chapel Road, Northwich	371100, 372024	7.8	6.1	9.6	6.0
2-O-H18	Holmes Chapel Road, Northwich	370473, 372047	7.9	6.2	9.3	5.9
2-O-H19	Pennys Lane, Northwich	369395, 372345	8.5	6.6	9.5	6.0
2-O-H20	Tudor Close, Northwich	368463, 372714	9.8	7.6	10.0	6.4
2-O-H21	Mulberry Close, Northwich	368729, 372831	9.8	7.6	10.0	6.4
2-O-H22	Birches Lane, Northwich	369744, 373348	8.7	6.8	10.3	6.4
2-O-H23	Birches Lane, Northwich	369457, 373605	8.7	6.8	10.3	6.4
2-O-H24	Birches Lane, Northwich	369427, 373863	8.7	6.8	10.3	6.4
2-O-H25	Birches Lane, Northwich	369201, 373956	8.7	6.8	10.3	6.4
2-O-H26	Harris Road, Northwich	369669, 374700	9.5	7.4	10.4	6.5
2-O-H27	Lostock Lodge, Northwich	369831, 375123	8.9	7.0	10.1	6.3

Assessment results

5.4.7 Table 24, Table 25 and Table 26 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[6].

Table 24: Predicted annual mean NO_2 concentrations and impacts (operation phase)

Receptor	Description/Location	NO_2 concentrations (µg/m^3) 2038 without the Proposed Scheme	Change in NO_2 concentrations (µg/m^3) 2038 with the Proposed Scheme	Impact descriptor		Significance
2-O-H01	Nantwich Road, Occleston	14.1	8.7	-5.4	Moderate beneficial	Significant
2-O-H02	Primary School, Occleston	11.3	11.3	< 0.1	Negligible	Not significant
2-O-H03	Nantwich Road, Occleston	11.0	11.0	< 0.1	Negligible	Not significant
2-O-H04	Clive Green Lane, Occleston	10.0	8.1	-1.9	Negligible	Not significant
2-O-H05	Clive Green Lane, Occleston	8.0	8.5	0.5	Negligible	Not significant
2-O-H06	Nantwich Road, Occleston	12.1	12.2	0.1	Negligible	Not significant
2-O-H07	Clive Green Lane, Winsford	8.7	9.4	0.7	Negligible	Not significant
2-O-H08	Clive Green Lane, Winsford	9.2	9.6	0.4	Negligible	Not significant
2-O-H09	Clive Green Lane, Winsford	13.3	13.8	0.5	Negligible	Not significant
2-O-H10	Middlewich Road, Winsford	13.7	13.9	0.2	Negligible	Not significant
2-O-H11	Middlewich Road, Winsford	10.2	10.2	< 0.1	Negligible	Not significant
2-O-H12	Nursery, Winsford	10.9	10.9	< 0.1	Negligible	Not significant
2-O-H13	Stanthorne Hall, Winsford	7.2	7.3	0.1	Negligible	Not significant
2-O-H14	Middlewich Road, Middlewich	11.1	11.0	-0.1	Negligible	Not significant
2-O-H15	Bostock Road, Winsford	8.0	7.6	-0.4	Negligible	Not significant
2-O-H16	Holmes Chapel Road, Allostock	11.4	11.6	0.2	Negligible	Not significant
2-O-H17	Holmes Chapel Road, Northwich	8.5	8.7	0.2	Negligible	Not significant
2-O-H18	Holmes Chapel Road, Northwich	8.8	9.1	0.3	Negligible	Not significant
2-O-H19	Pennys Lane, Northwich	8.1	8.5	0.4	Negligible	Not significant
2-O-H20	Tudor Close, Northwich	16.7	17.4	0.7	Negligible	Not significant
2-O-H21	Mulberry Close, Northwich	11.4	12.4	1.0	Negligible	Not significant

Receptor	Description/Location	NO_2 concentrations (µg/m³) 2038 without the Proposed Scheme	Change in NO_2 concentrations (µg/m³) 2038 with the Proposed Scheme	Impact descriptor		Significance
2-O-H22	Birches Lane, Northwich	7.9	8.0	0.1	Negligible	Not significant
2-O-H23	Birches Lane, Northwich	8.2	8.0	-0.2	Negligible	Not significant
2-O-H24	Birches Lane, Northwich	10.5	8.3	-2.2	Slight beneficial	Not significant
2-O-H25	Birches Lane, Northwich	8.0	8.4	0.4	Negligible	Not significant
2-O-H26	Harris Road, Northwich	10.0	9.9	-0.1	Negligible	Not significant
2-O-H27	Lostock Lodge, Northwich	9.7	9.7	< 0.1	Negligible	Not significant

Table 25: Predicted annual mean PM_{10} concentrations and impacts (operation phase)

Receptor	Description/Location	PM_{10} concentrations (µg/m3) 2038 without the Proposed Scheme	Change in PM_{10} concentrations (µg/m3) 2038 with the Proposed Scheme	Impact descriptor		Significance
2-O-H01	Nantwich Road, Occleston	11.0	9.6	-1.4	Negligible	Not significant
2-O-H02	Primary School, Occleston	10.6	10.6	< 0.1	Negligible	Not significant
2-O-H03	Nantwich Road, Occleston	11.6	11.6	< 0.1	Negligible	Not significant
2-O-H04	Clive Green Lane, Occleston	11.0	10.5	-0.5	Negligible	Not significant
2-O-H05	Clive Green Lane, Occleston	10.2	10.3	0.1	Negligible	Not significant
2-O-H06	Nantwich Road, Occleston	11.1	11.1	< 0.1	Negligible	Not significant
2-O-H07	Clive Green Lane, Winsford	10.3	10.5	0.2	Negligible	Not significant
2-O-H08	Clive Green Lane, Winsford	10.4	10.5	0.1	Negligible	Not significant
2-O-H09	Clive Green Lane, Winsford	10.7	10.8	0.1	Negligible	Not significant
2-O-H10	Middlewich Road, Winsford	10.9	10.9	< 0.1	Negligible	Not significant
2-O-H11	Middlewich Road, Winsford	10.0	10.0	< 0.1	Negligible	Not significant

Receptor	Description/Location	PM_{10} concentrations (µg/m3) 2038 without the Proposed Scheme	Change in PM_{10} concentrations (µg/m3) 2038 with the Proposed Scheme	Impact descriptor		Significance
2-O-H12	Nursery, Winsford	10.3	10.3	< 0.1	Negligible	Not significant
2-O-H13	Stanthorne Hall, Winsford	10.5	10.6	0.1	Negligible	Not significant
2-O-H14	Middlewich Road, Middlewich	10.9	10.9	< 0.1	Negligible	Not significant
2-O-H15	Bostock Road, Winsford	10.5	10.4	-0.1	Negligible	Not significant
2-O-H16	Holmes Chapel Road, Allostock	12.3	12.4	0.1	Negligible	Not significant
2-O-H17	Holmes Chapel Road, Northwich	10.5	10.6	0.1	Negligible	Not significant
2-O-H18	Holmes Chapel Road, Northwich	10.1	10.2	0.1	Negligible	Not significant
2-O-H19	Pennys Lane, Northwich	10.1	10.2	0.1	Negligible	Not significant
2-O-H20	Tudor Close, Northwich	12.3	12.6	0.3	Negligible	Not significant
2-O-H21	Mulberry Close, Northwich	11.3	11.7	0.4	Negligible	Not significant
2-O-H22	Birches Lane, Northwich	10.7	10.7	< 0.1	Negligible	Not significant
2-O-H23	Birches Lane, Northwich	10.7	10.7	< 0.1	Negligible	Not significant
2-O-H24	Birches Lane, Northwich	11.5	10.8	-0.7	Negligible	Not significant
2-O-H25	Birches Lane, Northwich	10.7	10.8	0.1	Negligible	Not significant
2-O-H26	Harris Road, Northwich	11.3	11.3	< 0.1	Negligible	Not significant
2-O-H27	Lostock Lodge, Northwich	11.1	11.1	< 0.1	Negligible	Not significant

Table 26: Predicted annual mean $PM_{2.5}$ concentrations and impacts (operation phase)

Receptor	Description/Location	$PM_{2.5}$ concentrations (µg/m^3) 2038 without the Proposed Scheme	$PM_{2.5}$ concentrations (µg/m^3) 2038 with the Proposed Scheme	Change in $PM_{2.5}$ concentrations (µg/m^3)	Impact descriptor	Significance
2-O-H01	Nantwich Road, Occleston	6.9	6.1	-0.8	Negligible	Not significant
2-O-H02	Primary School, Occleston	6.7	6.7	< 0.1	Negligible	Not significant

Receptor	Description/Location	$PM_{2.5}$ concentrations ($\mu g/m^3$) 2038 without the Proposed Scheme	$PM_{2.5}$ concentrations ($\mu g/m^3$) 2038 with the Proposed Scheme	Change in $PM_{2.5}$ concentrations ($\mu g/m^3$)	Impact descriptor	Significance
2-O-H03	Nantwich Road, Occleston	6.9	6.9	< 0.1	Negligible	Not significant
2-O-H04	Clive Green Lane, Occleston	6.7	6.4	-0.3	Negligible	Not significant
2-O-H05	Clive Green Lane, Occleston	6.4	6.4	< 0.1	Negligible	Not significant
2-O-H06	Nantwich Road, Occleston	7.0	7.0	< 0.1	Negligible	Not significant
2-O-H07	Clive Green Lane, Winsford	6.4	6.5	0.1	Negligible	Not significant
2-O-H08	Clive Green Lane, Winsford	6.5	6.5	< 0.1	Negligible	Not significant
2-O-H09	Clive Green Lane, Winsford	6.9	7.0	0.1	Negligible	Not significant
2-O-H10	Middlewich Road, Winsford	7.0	7.0	< 0.1	Negligible	Not significant
2-O-H11	Middlewich Road, Winsford	6.5	6.5	< 0.1	Negligible	Not significant
2-O-H12	Nursery, Winsford	6.7	6.7	< 0.1	Negligible	Not significant
2-O-H13	Stanthorne Hall, Winsford	6.4	6.4	< 0.1	Negligible	Not significant
2-O-H14	Middlewich Road, Middlewich	7.0	7.0	< 0.1	Negligible	Not significant
2-O-H15	Bostock Road, Winsford	6.4	6.4	< 0.1	Negligible	Not significant
2-O-H16	Holmes Chapel Road, Allostock	8.5	8.5	< 0.1	Negligible	Not significant
2-O-H17	Holmes Chapel Road, Northwich	6.5	6.5	< 0.1	Negligible	Not significant
2-O-H18	Holmes Chapel Road, Northwich	6.4	6.4	< 0.1	Negligible	Not significant
2-O-H19	Pennys Lane, Northwich	6.3	6.4	0.1	Negligible	Not significant
2-O-H20	Tudor Close, Northwich	7.7	7.9	0.2	Negligible	Not significant
2-O-H21	Mulberry Close, Northwich	7.1	7.4	0.3	Negligible	Not significant
2-O-H22	Birches Lane, Northwich	6.6	6.6	< 0.1	Negligible	Not significant
2-O-H23	Birches Lane, Northwich	6.6	6.6	< 0.1	Negligible	Not significant
2-O-H24	Birches Lane, Northwich	7.1	6.6	-0.5	Negligible	Not significant
2-O-H25	Birches Lane, Northwich	6.6	6.7	0.1	Negligible	Not significant

Receptor	Description/Location	$PM_{2.5}$ concentrations ($\mu g/m^3$) 2038 without the Proposed Scheme	$PM_{2.5}$ concentrations ($\mu g/m^3$) 2038 with the Proposed Scheme	Change in $PM_{2.5}$ concentrations ($\mu g/m^3$)	Impact descriptor	Significance
2-O-H26	Harris Road, Northwich	7.0	7.0	< 0.1	Negligible	Not significant
2-O-H27	Lostock Lodge, Northwich	6.9	6.9	< 0.1	Negligible	Not significant

5.4.8 The annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are predicted to be within the air quality standards with and without 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.

5.4.9 Negligible impacts are predicted at the majority of receptors for annual mean NO_2 concentrations. One modelled residential receptor is predicted to experience significant beneficial effects for NO_2 concentrations in the Wimboldsley to Lostock Gralam area. This is Manor Cottage located on the A530 Nantwich Road, Occleston due to the realignment of this road. Negligible impacts are predicted at all human receptors for annual mean PM_{10} and $PM_{2.5}$ concentrations.

Assessment of significance

5.4.10 No significant effects are anticipated at any receptors in relation to annual mean PM_{10} and $PM_{2.5}$ concentrations. A significant beneficial effect is predicted at one receptor for annual mean NO_2 concentrations. This is located at the A530 Nantwich Road, Occleston.

6 Assessment of rail emissions

6.1 Overall assessment approach

6.1.1 The air quality assessment for rail emissions has used the approach described in the SMR (see Appendix: CT-001-00001).

6.2 Assessment of rail emissions during construction

6.2.1 The operation of diesel trains associated with the Crewe North Rolling Stock Depot (RSD) construction sidings has been assessed for their emissions of NO_2 and sulphur dioxide (SO_2) to local air quality.

6.2.2 Screening criteria are set out by Defra[7] to determine the potential risk of exceedance from stationary diesel and/or moving locomotives at relevant sensitive receptors.

6.2.3 There are no locations of relevant exposure within 15m of where diesel locomotives will be regularly (at least three times a day) stationary for periods of 15 minutes. The risk of exceedance of the 15-minute SO_2 air quality standard is therefore considered to be negligible.

6.2.4 Background annual mean NO_2 concentrations around the Crewe North RSD construction sidings are lower than 25µg/m^3. Therefore, the risk of exceedance of the annual mean NO_2 standard is considered to be negligible.

6.2.5 No significant effects are anticipated at any receptor in relation to diesel trains operating at the Crewe North RSD construction sidings during construction of the Proposed Scheme.

6.3 Assessment of rail emissions during operation

6.3.1 There will be no direct atmospheric emissions from trains operating on the Proposed Scheme since they will use electric traction. No assessment is therefore required. Indirect emissions from sources such as rail and brake wear have been assumed to be negligible.

[7] Department for Environment, Food and Rural Affairs (Defra) (2016), *Local Air Quality Management Technical Guidance (LAQM.TG16).* Available online at: https://laqm.defra.gov.uk/guidance/.

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