In Parliament – Session 2022 - 2023

HS2

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

Volume 5: Appendix AQ-001-0MA01

Air quality

Air quality report

MA01: Hough to Walley's Green

S28

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Department for Transport

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Contents

Tables

1 Introduction

1.1 Structure of this appendix

1.1.1 This report is an appendix to the air quality assessment which forms part of Volume 5 of the Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES) for the Hough to Walley's Green (MA01) community area.

1.1.2 This appendix provides details of changes to the air quality assessment since the High Speed Two (HS2) High Speed Rail (Crewe – Manchester) Environmental Statement (ES) published in 2022[1] (the main ES), and the Supplementary Environmental Statement 1 (SES1) and Additional Provision 1 Environmental Statement (AP1 ES) also published in 2022[2].

1.1.3 This report should be read in conjunction with the main ES Volume 5, Appendix: AQ-001-0MA01 and SES1 and AP1 ES Volume 5, Appendix: AQ-001-0MA01.

1.1.4 In order to differentiate between the original scheme and the subsequent changes, the following terms are used:

- 'the original scheme' – the Bill scheme submitted to Parliament in 2022, which was assessed in the main ES;
- 'the SES1 scheme' – the original scheme with any changes described in SES1 that are within the existing powers of the Bill;
- 'the AP1 revised scheme' – the original scheme as amended by SES1 changes and AP1 amendments;
- 'the SES2 scheme' – the original scheme with any changes described in SES1 (submitted in July 2022) and the SES2; and
- 'the AP2 revised scheme' – the original scheme as amended by SES1 and SES2 changes (as relevant) and AP2 amendments.

1.1.5 Maps relevant to this appendix are contained in the SES2 and AP2 ES Volume 5 Air quality Map Book: Map Series AQ-01- Monitoring Locations and Receptors.

[1] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement.* Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement.

1.1.6 In addition, the traffic data used for the air quality assessment is set out in Background Information and Data (BID)[3] which accompanies the SES2 and AP2 ES (see BID AQ-002-0MA01 SES2 and AP2 ES).

1.1.7 Where it has been possible to differentiate the air quality assessment between the SES2 changes and the AP2 amendments, this has been done and presented in this report. However, the assessment of road traffic emissions is a combined assessment of both SES2 changes and AP2 amendments in this area.

1.2 Scope, methodology, data sources, assumptions and limitations

1.2.1 The assessment scope, key assumptions and limitations are as set out in the main ES Environmental Impact Assessment Scope and Methodology Report (SMR)[4] (see main ES Volume 5: Appendix CT-001-00001).

1.2.2 Since the preparation of the main ES, the Department for Environment, Food and Rural Affairs (Defra) has released new versions of tools for undertaking air quality assessments[5], namely the emissions factors toolkit. This air quality assessment has therefore used the latest available tools.

1.2.3 The air quality standards for 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 NO_2 concentrations, 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 PM_{10} concentrations, not to be exceeded more than 35 times a year (equivalent to the 90.4th percentile of the 24-hour mean); and
- 20µg/m^3 as an annual mean for very fine particulate matter ($PM_{2.5}$).

[3] High Speed Two Ltd (2023), High Speed Rail (Crewe – Manchester), *Background Information and Data accompanying Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement, Additional data used in the air quality assessment,* BID AQ-002-0MA01 SES2 and AP2 ES. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-2-and-additional-provision-2-environmental-statement.

[4] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Environmental Impact Assessment Scope and Methodology Report,* Volume 5, Appendix: CT-001-00001. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[5] Department for Environment, Food and Rural Affairs (2022). *Local air quality management.* Available online at: https://laqm.defra.gov.uk/whatsnew.html.

2 Baseline air quality data

2.1 Existing air quality

Background pollutant concentrations

2.1.1 Estimates of background air quality were obtained from the Defra maps[6]. Background pollutant concentrations are within the air quality standards throughout the study area. Table 1 presents the range of background pollutant concentrations in the Hough to Walley's Green (MA01) community area for the future baseline. The 2018 background pollutant concentrations remain the same as the main ES.

2.1.2 Background pollutant concentrations for the operational year of 2039 have been taken from the Defra background maps for 2030, which is the latest available year of data. The 2030 background maps have been used as representative of the future baseline conditions during operation of the AP2 revised scheme.

Table 1: Range of background pollutant concentrations

Pollutant	Background concentrations (µg/m^3)	
	2026	2039
Annual mean NOx	6.2µg/m^3 to 19.4µg/m^3	5.8µg/m^3 to 18.7µg/m^3
Annual mean NO_2	4.9µg/m^3 to 14.0µg/m^3	4.7µg/m^3 to 13.6µg/m^3
Annual mean PM_{10}	8.8µg/m^3 to 12.3µg/m^3	8.7µg/m^3 to 12.3µg/m^3
Annual mean $PM_{2.5}$	5.7µg/m^3 to 8.1µg/m^3	5.6µg/m^3 to 8.1µg/m^3

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

3 Construction dust assessment

3.1 Introduction

3.1.1 This section provides details of the assessment of dust emissions during construction of the AP2 revised scheme. The assessment is provided separately for each proposed amendment to the design, where it has been identified that the amendment has the potential to change the risk of dust soiling, human health effects or ecological effects compared to the main ES as amended by SES1 and AP1 ES. A summary is then provided of the overall risk from construction dust in the Hough to Walley's Green (MA01) community area, and how it has changed from that reported in the main ES as amended by SES1 and AP1 ES.

3.2 Additional land temporarily required for modifications to the B5076 Bradfield Road and Parkers Road junction (AP2-001-001)

Dust soiling and human health effects

3.2.1 There are no changes to the air quality reported information in the SES1 and AP1 ES, for this design element for dust soiling and human health effects during construction of the AP2 revised scheme.

Ecological effects

Assessed receptors and sensitivity of the area

3.2.2 An assessment of ecological effects has been undertaken for the following ecological receptors that are affected by the junction modifications (AP2-001-001), from south to north:

- Mere Gutter with Basford Brook Local Wildlife Site (LWS): there are no demolition activities in this area. The LWS is located within 20m of earthworks, construction and trackout[7] activities; and
- Crewe Station Woodland LWS: there are no demolition activities in this area. The LWS is located within 20m of earthworks, construction and trackout activities.

3.2.3 The sensitivity of the area to ecological effects is defined as low for all dust generating activities.

[7] 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.

Dust emission magnitude

3.2.4 Each dust generating activity has been assigned a dust emission magnitude as shown in Table 2.

Table 2: Dust emission magnitude for ecological effects

Area	Demolition	Earthworks	Construction	Trackout
Mere Gutter with Basford Brook LWS	Not applicable	Large	Large	Large
Crewe Station Woodland LWS	Not applicable	Large	Large	Large

Risk of impacts

3.2.5 Taking into consideration the dust emission magnitude of each activity and the sensitivity of the area, the risk of dust effects has been defined as shown in Table 3.

Table 3: Risk of ecological effects

Area	Demolition	Earthworks	Construction	Trackout
Mere Gutter with Basford Brook LWS	Not applicable	Low risk	Low risk	Low risk
Crewe Station Woodland LWS	Not applicable	Low risk	Low risk	Low risk

3.3 Additional land temporarily required for modifications to the A534 Old Mill Road and Congleton Road junction (AP2-001-003)

Dust soiling and human health effects

3.3.1 There are no changes to the air quality reported information in the SES1 and AP1 ES, for this design element for dust soiling and human health effects during construction of the AP2 revised scheme.

Ecological effects

Assessed receptors and sensitivity of the area

3.3.2 An assessment of ecological effects has been undertaken for ecological receptors Larch Wood LWS and Burnt Covert LWS that are affected by this design element. There are no demolition or trackout activities in this area. Both ecological sites are located within 20m of earthworks and construction activities.

3.3.3 The sensitivity of the area to ecological effects is defined as low for all dust generating activities.

Dust emission magnitude

3.3.4 Each dust generating activity has been assigned a dust emission magnitude as shown in Table 4.

Table 4: Dust emission magnitude for ecological effects

Area	Demolition	Earthworks	Construction	Trackout
Larch Wood LWS and Burnt Covert LWS	Not applicable	Large	Large	Not applicable

Risk of impacts

3.3.5 Taking into consideration the dust emission magnitude of each activity and the sensitivity of the area, the risk of dust effects has been defined as shown in Table 5.

Table 5: Risk of ecological effects

Area	Demolition	Earthworks	Construction	Trackout
Larch Wood LWS and Burnt Covert LWS	Not applicable	Low risk	Low risk	Not applicable

Summary of risks

3.3.6 This section summarises the risks for construction dust for the Hough to Walley's Green (MA01) community area. The risks identified for these junction modifications (AP2-001-001 and AP2-001-003) are summarised in Table 6. Table 7 summarises the new overall risk for the whole of the Hough to Walley's Green (MA01) community area.

3.3.7 Table 7 shows that the risk summary for the whole Hough to Walley's Green (MA01) community area is the same between that reported in the main ES as amended by SES1 and AP1 ES, and for the AP2 revised scheme. This assessment does not change the conclusion of the main ES as amended by SES1 with the proposed AP1 amendments if approved.

Table 6: Summary of risks for construction dust assessment accounting for the AP2 amendments (areas affected by the AP2 revised scheme)

Activity	Dust Soiling	Human Health	Ecological Effects
Demolition	Not applicable	Not applicable	Not applicable
Earthworks	Not applicable	Not applicable	Low
Construction	Not applicable	Not applicable	Low
Trackout	Not applicable	Not applicable	Low

Table 7: Summary of risks for construction dust assessment accounting for the AP2 amendments (Hough to Walley's Green (MA01) community area)

Activity	Dust Soiling	Human Health	Ecological Effects
Demolition	Negligible to medium	Negligible to low	Not applicable
Earthworks	Medium to high	Medium	Low

Activity	Dust Soiling	Human Health	Ecological Effects
Construction	Medium to high	Medium	Low
Trackout	Medium to high	Low to medium	Low

4 Assessment of road traffic emissions

4.1 Overview

4.1.1 This section provides details of the assessment of road traffic emissions during construction of the AP2 revised scheme. The assessment considers the combined effects of SES2 changes and AP2 amendments in this area.

4.2 Model verification

4.2.1 Since the main ES, as amended by SES1 and AP1 ES, additional traffic information has been collected, as well as further information relating to local junction modelling. As a result of this, revised traffic data for the baseline year of 2018 and future baseline years for construction and operation has become available. The model verification has therefore been updated to take account of this revised baseline traffic data.

4.2.2 Model verification was undertaken on a route-wide basis 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.

4.2.3 Some monitoring locations were not considered suitable for model verification, due to missing traffic or monitoring data, or other spatial considerations. A total of 23 monitoring sites, spread across both Hough to Walley's Green (MA01) and Wimboldsley to Lostock Gralam (MA02) community areas, were included in the model verification exercise. The comparison of monitored and modelled NO_2 concentrations is shown in Table 8.

Table 8: Comparison of monitored and modelled NO_2 concentrations

Site	Monitored concentration (µg/m³)	Modelled concentration (µg/m³)	Percent Difference (modelled - monitored/monitored)
MA01.1[a]	28.0	14.0	-50.2%
MA01.2[a]	38.8	23.7	-39.0%
MA01.3[a]	31.5	18.9	-40.1%
MA01.8[a]	34.3	19.8	-42.3%
MA01.9[a]	32.7	22.0	-32.6%
MA01.15[a]	34.9	19.3	-44.7%
MA01.17[a]	26.9	16.8	-37.6%
MA01.18[a]	32.6	16.4	-49.7%
MA02.19[b]	28.2	16.6	-41.3%
MA02.20[b]	35.6	21.9	-38.3%
MA02.21[b]	48.5	30.7	-36.8%
MA02.22[a]	25.4	17.2	-32.3%
MA02.23[a]	35.1	16.1	-54.3%
MA02.30[c]	39.5	18.9	-52.2%

Site	Monitored concentration (µg/m³)	Modelled concentration (µg/m³)	Percent Difference (modelled - monitored/monitored)
MA02.33[a]	31.2	19.3	-38.2%
MA02.35[a]	36.7	18.2	-50.3%
MA02.41[b]	32.0	20.3	-36.4%
MA02.42[b]	38.0	21.1	-44.6%
MA02.43[a]	31.7	20.9	-34.1%
MA02.44[d]	21.3	21.4	0.3%
CE134[c]	34.4	17.2	-49.8%
CE270[c]	34.0	19.3	-43.4%
CE282[c]	41.9	20.8	-50.4%

Note: [a] denotes sites used to derive the adjustment factor for locations covered by the Crewe and Winsford transport models. [b] denotes sites used to derive the adjustment factor for locations covered by the Northwich transport model. [c] denotes sites used to derive the adjustment factor for locations along Lewin Street (Middlewich). [d] denotes sites used to derive the adjustment factor for locations along the M6.

4.2.4 As most of the modelled NO_2 concentrations were greater than ±25% of the monitored concentrations, and there was systematic under prediction, model adjustment was undertaken. Four adjustment factors were calculated: a factor of 1.0 for locations along the M6, a factor of 2.3 for locations covered by the Northwich transport model (which includes Moulton, Northwich, Lach Dennis, Lostock Gralam and Wincham); a factor of 2.6 for locations covered by the Crewe and Winsford transport models (which include Crewe, Middlewich, Winsford) and a factor of 3.9 for locations along Lewin Street (Middlewich). Modelled concentrations of PM_{10} and $PM_{2.5}$ have not been adjusted. The comparison of monitored and adjusted modelled NO_2 concentrations is shown in Table 9.

Table 9: Comparison of monitored and adjusted modelled NO_2 concentrations

Site	Monitored concentration (µg/m³)	Modelled adjusted concentration (µg/m³)	Percent difference (modelled – monitored/monitored)
MA01.1[a]	28.0	21.3	-24.1%
MA01.2[a]	38.8	45.1	16.3%
MA01.3[a]	31.5	29.6	-6.0%
MA01.8[a]	34.3	31.1	-9.2%
MA01.9[a]	32.7	36.4	11.3%
MA01.15[a]	34.9	30.6	-12.4%
MA01.17[a]	26.9	25.6	-5.0%
MA01.18[a]	32.6	24.5	-25.1%
MA02.19[b]	28.2	24.7	-12.3%
MA02.20[b]	35.6	35.7	0.3%
MA02.21[b]	48.5	51.7	6.6%
MA02.22[a]	25.4	26.2	2.9%
MA02.23[a]	35.1	27.3	-22.3%
MA02.30[c]	39.5	36.5	-7.4%

Site	Monitored concentration (µg/m³)	Modelled adjusted concentration (µg/m³)	Percent difference (modelled – monitored/monitored)
MA02.33[a]	31.2	33.1	6.2%
MA02.35[a]	36.7	30.7	-16.4%
MA02.41[b]	32.0	31.7	-0.9%
MA02.42[b]	38.0	32.6	-14.2%
MA02.43[a]	31.7	38.4	21.0%
MA02.44[d]	21.3	21.4	0.3%
CE134[c]	34.4	31.1	-9.4%
CE270[c]	34.0	38.0	11.5%
CE282[c]	41.9	42.7	2.1%

Note: [a] denotes sites used to derive the adjustment factor for locations covered by the Crewe and Winsford transport models. [b] denotes sites used to derive the adjustment factor for locations covered by the Northwich transport model. [c] denotes sites used to derive the adjustment factor for locations along Lewin Street (Middlewich). [d] denotes sites used to derive the adjustment factor for locations along the M6.

4.3 Assessment of construction traffic emissions

4.3.1 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 (2026–2039). However, vehicle emissions and background concentrations have been taken for the first construction year in 2026. Two construction scenarios have been assessed for air quality 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 AP2 revised 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 AP2 revised scheme.

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 also been included in the assessment where relevant to account for their emissions at nearby receptors.

Receptors assessed and background concentrations

4.3.4 Details of the assessed receptors and the background concentrations used in the assessment remain as reported within the SES1 and AP1 ES. There was one human receptor modelled in the main ES as amended by SES1 and AP1 ES that has not been modelled as part of the AP2 revised scheme due to changes in the study area. No receptors have been

added to the study area. The human receptors and background concentrations are shown in Table 10. The location of all receptors are shown in the accompanying SES2 and AP2 ES Volume 5, Air quality Map Book: Map Series AQ-01 – Air Quality Monitoring Locations and Receptors.

4.3.5 One designated ecological receptor, Oakhanger Moss Site of Special Scientific Interest (SSSI), which is part of the Midland Meres and Mosses Phase 2 Ramsar site, was identified within 200m of the screened in roads within the Hough to Walley's Green (MA01) community area during construction of the AP2 revised scheme.

4.3.6 Table 11 shows the background concentrations for NOx, background nitrogen deposition and critical loads. Table 12 shows the background acid deposition, critical loads and background ammonia concentrations. Acid deposition and ammonia were not previously assessed in the main ES. It should be noted that the main ES included consideration of broadleaved deciduous woodland habitat within the Oakhanger Moss SSSI/Midland Meres and Mosses Phase 2 Ramsar site, as well as lowland raised bog. However, upon further review for the AP2 revised scheme assessment it has been concluded that only lowland raised bog habitat is of concern at this site. Furthermore, Oakhanger Moss was assessed for 2028, which was selected based on the worse case peak period during the construction programme and when significant effects might be expected. For this area, the worst case peak period for construction traffic is from 2028 to 2031. The construction scenarios assessed therefore use 2028 emission factors and, where relevant, background concentrations as an overall worst case.

Table 10: Modelled human receptors and background concentrations (construction phase)

Receptor	Description/Location	Ordnance Survey coordinates	Background concentrations in 2026 (µg/m^3)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
01-C-H001	A500, Shavington Bypass, Willaston	367533,351669	7.5	5.9	9.9	6.2
01-C-H002	Casey Lane, Basford	371849, 351712	7.5	5.9	9.7	6.0
01-C-H004	The B5338 Crewe Road, Willaston	366967, 352590	8.1	6.3	9.8	6.3
01-C-H005	A500, Shavington Bypass, Weston	372694, 352799	8.1	6.4	10.7	6.4
01-C-H006	Barthomley Road, Barthomley	376019, 352986	9.0	7.1	11.3	6.7
01-C-H008	Middlewich Road, A51, Woolstanwood	367334, 355041	9.7	7.5	10.3	6.6
01-C-H009	Crewe Green Roundabout, Crewe	372266, 355465	10.5	8.1	10.3	6.7
01-C-H014	Sydney Road, Crewe	371405, 357052	13.0	9.9	10.0	6.5
01-C-H015	Sydney Road, Crewe	371401, 357082	13.0	9.9	10.0	6.5
01-C-H017	Remer Street, Crewe	371338, 357134	13.0	9.9	10.0	6.5
01-C-H022	Clay Lane, Haslington	373530, 357300	9.3	7.2	9.8	6.4
01-C-H030	Maw Lane, Haslington	372993, 357498	9.9	7.6	9.6	6.3
01-C-H034	Hassall Road, Day Green	377886, 357680	8.8	6.9	11.6	7.2
01-C-H035	B5076, Bradfield Road, Crewe	368931, 357821	10.6	8.2	10.0	6.5
01-C-H039	B5076, Bradfield Road, Crewe	368837, 357941	10.6	8.2	10.0	6.5
01-C-H040	Parkers Road, Crewe	369891, 358049	9.1	7.1	9.6	6.4

Receptor	Description/Location	Ordnance Survey coordinates	Background concentrations in 2026 (µg/m³)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
01-C-H041	Alsager Road, Hassall Green	377644, 358297	9.8	7.6	11.8	7.2
01-C-H042	Warmingham Road, Crewe	370561, 358429	8.7	6.8	9.5	6.2
01-C-H044	Middlewich Road, Bradfield Green	368048, 358879	9.5	7.4	10.3	6.3
01-C-H046	Brookhouse Road, Sandbach	375946, 360565	11.0	8.4	10.3	6.7
01-C-H047	Warmingham CofE Primary, Warmingham	371199, 361523	8.2	6.4	9.3	5.9
01-C-H048	London Road, Elworth	373794, 361681	11.2	8.6	9.5	6.3
01-C-H049	Middlewich Road, Minshull Vernon	368333, 361922	8.5	6.6	9.8	6.0
01-C-H120	Crewe Road, Willaston	367458, 352779	7.8	6.2	9.8	6.4

Table 11: Modelled ecological receptor backgrounds and critical loads (construction phase)

Receptor	Sensitive habitat	2028 NOx background concentration (µg/m³)	APIS data of average total N deposition (kg N/ha/yr)	APIS Critical load (kg N/ha/yr)
Oakhanger Moss SSSI/ Midland Meres and Mosses Phase 2 Ramsar site	Hydrological buffer woodland	8.7	56.5	10
	Lowland raised bog	8.7	56.5	5

Table 12: Modelled ecological receptor acid deposition backgrounds, critical loads and ammonia background concentrations (construction phase)

Receptor	Sensitive habitat	APIS data of average total acid deposition (k eq/ha/yr)	APIS Critical load nitrogen (k eq/ha/yr) (min)	APIS Critical load nitrogen (k eq/ha/yr) (max)	APIS Critical load sulphur (k eq/ha/yr) (max)	APIS Ammonia background concentration (µg/m³)
Oakhanger Moss SSSI/ Midland Meres and Mosses Phase 2 Ramsar site	Hydrological buffer woodland	4.2	0.1	1.0	1.1	4.5
	Lowland raised bog	4.2	0.3	0.6	0.3	4.5

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 $PM_{2.5}$ concentrations. Table 14 to Table 16 provide the summary of the worst-case modelled pollutant concentrations at each assessed receptor (i.e., the highest modelled concentration at a particular receptor given the different construction traffic scenarios). The magnitude of change and impact descriptor are also provided along with a comparison against the main ES, or alternatively the main ES as amended by SES1 and AP1 ES. These were derived for human receptors

following the Institute of Air Quality Management (IAQM)/Environmental Protection UK (EPUK) methodology[8].

4.3.8 Table 18 provides a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[9]. Table 19 provides a summary of the nitrogen deposition receptor results with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool. Table 19 provides a summary of the acid deposition receptor results with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool.

Table 13: Comparison of impact descriptors for annual mean NO_2 concentrations across construction scenarios

Receptor	Impact descriptors for annual mean NO_2 concentrations	
	Scenario 1	Scenario 2
01-C-H001	Negligible	Negligible
01-C-H002	Negligible	Negligible
01-C-H004	Negligible	Negligible
01-C-H005	Negligible	Negligible
01-C-H006	Negligible	Negligible
01-C-H008	Negligible	Negligible
01-C-H009	Negligible	Negligible
01-C-H014	Negligible	Negligible
01-C-H015	Negligible	Negligible
01-C-H017	Negligible	Slight adverse
01-C-H022	Negligible	Negligible
01-C-H030	Negligible	Negligible
01-C-H034	Negligible	Negligible
01-C-H035	Negligible	Negligible
01-C-H039	Slight adverse	Negligible
01-C-H040	Negligible	Negligible
01-C-H041	Negligible	Negligible
01-C-H042	Negligible	Negligible
01-C-H044	Negligible	Negligible
01-C-H046	Negligible	Negligible
01-C-H047	Negligible	Negligible
01-C-H048	Negligible	Negligible
01-C-H049	Negligible	Negligible
01-C-H120	Negligible	Negligible

[8] Institute of Air Quality Management (2017*), Land-Use planning & development control: Planning for air quality, v1.2.* Available online at: https://iaqm.co.uk/guidance/.

[9] National Highways (2021), *Ammonia N Deposition Tool V2*.

Table 14: Predicted annual mean NO_2 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	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2026 without the AP2 revised scheme	2026 with the AP2 revised scheme				
01-C-H001	A500, Shavington Bypass, Willaston	27.3	26.5	<0.1	Negligible	Negligible	Not significant
01-C-H002	Casey Lane, Basford	7.3	7.9	0.6	Negligible	Negligible	Not significant
01-C-H004	The B5338 Crewe Road, Willaston	19.3	20.0	0.7	Negligible	Negligible	Not significant
01-C-H005	A500, Shavington Bypass, Weston	27.3	27.5	0.2	Negligible	Negligible	Not significant
01-C-H006	Barthomley Road, Barthomley	16.8	16.8	<0.1	Negligible	Negligible	Not significant
01-C-H008	Middlewich Road, A51, Woolstanwood	20.9	21.0	0.1	Negligible	Negligible	Not significant
01-C-H009	Crewe Green Roundabout, Crewe	25.7	26.4	0.7	Negligible	Negligible	Not significant
01-C-H014	Sydney Road, Crewe	24.5	24.8	0.3	Negligible	Negligible	Not significant
01-C-H015	Sydney Road, Crewe	24.0	24.8	0.8	Negligible	Negligible	Not significant
01-C-H017	Remer Street, Crewe	29.6	30.5	0.9	Slight adverse	Slight adverse	Not significant
01-C-H022	Clay Lane, Haslington	20.5	22.2	1.7	Negligible	Negligible	Not significant
01-C-H030	Maw Lane, Haslington	15.2	16.9	1.7	Negligible	Negligible	Not significant
01-C-H034	Hassall Road, Day Green	17.0	17.7	0.7	Negligible	Negligible	Not significant
01-C-H035	B5076, Bradfield Road, Crewe	18.9	19.4	0.5	Negligible	Negligible	Not significant
01-C-H039	B5076, Bradfield Road, Crewe	29.8	30.8	1.0	Slight adverse	Negligible	Not significant
01-C-H040	Parkers Road, Crewe	15.7	16.6	0.9	Negligible	Slight adverse	Not significant
01-C-H041	Alsager Road, Hassall Green	29.8	30.2	0.4	Negligible	Negligible	Not significant
01-C-H042	Warmingham Road, Crewe	15.0	16.5	1.5	Negligible	Negligible	Not significant
01-C-H044	Middlewich Road, Bradfield Green	25.0	25.6	0.6	Negligible	Negligible	Not significant

Receptor	Description/Location	NO_2 concentrations (µg/m³)		Change in NO_2 concentrations (µg/m³)	Impact descriptor	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2026 without the AP2 revised scheme	2026 with the AP2 revised scheme				
01-C-H046	Brookhouse Road, Sandbach	19.1	19.5	0.4	Negligible	Negligible	Not significant
01-C-H047	Warmingham CofE Primary, Warmingham	18.8	20.1	1.3	Negligible	Negligible	Not significant
01-C-H048	London Road, Elworth	24.5	25.5	1.0	Negligible	Negligible	Not significant
01-C-H049	Middlewich Road, Minshull Vernon	20.4	18.7	<0.1	Negligible	Negligible	Not significant
01-C-H120	Crewe Road, Willaston	14.2	14.8	0.6	Negligible	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	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2026 without the AP2 revised scheme	2026 with the AP2 revised scheme				
01-C-H001	A500, Shavington Bypass, Willaston	11.6	11.7	0.1	Negligible	Negligible	Not significant
01-C-H002	Casey Lane, Basford	9.8	9.9	0.1	Negligible	Negligible	Not significant
01-C-H004	The B5338 Crewe Road, Willaston	11.0	11.1	0.1	Negligible	Negligible	Not significant
01-C-H005	A500, Shavington Bypass, Weston	12.1	12.1	<0.1	Negligible	Negligible	Not significant
01-C-H006	Barthomley Road, Barthomley	12.1	12.1	<0.1	Negligible	Negligible	Not significant
01-C-H008	Middlewich Road, A51, Woolstanwood	11.7	11.8	0.1	Negligible	Negligible	Not significant
01-C-H009	Crewe Green Roundabout, Crewe	12.4	12.5	0.1	Negligible	Negligible	Not significant
01-C-H014	Sydney Road, Crewe	12.1	12.1	<0.1	Negligible	Negligible	Not significant
01-C-H015	Sydney Road, Crewe	11.8	11.9	0.1	Negligible	Negligible	Not significant
01-C-H017	Remer Street, Crewe	12.5	12.6	0.1	Negligible	Negligible	Not significant

Receptor	Description/Location	PM_{10} concentrations (µg/m³)		Change in PM_{10} concentrations (µg/m³)	Impact descriptor	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2026 without the AP2 revised scheme	2026 with the AP2 revised scheme				
01-C-H022	Clay Lane, Haslington	11.2	11.4	0.2	Negligible	Negligible	Not significant
01-C-H030	Maw Lane, Haslington	10.3	10.5	0.2	Negligible	Negligible	Not significant
01-C-H034	Hassall Road, Day Green	12.6	12.7	0.1	Negligible	Negligible	Not significant
01-C-H035	B5076, Bradfield Road, Crewe	11.3	11.4	0.1	Negligible	Negligible	Not significant
01-C-H039	B5076, Bradfield Road, Crewe	13.0	13.2	0.2	Negligible	Negligible	Not significant
01-C-H040	Parkers Road, Crewe	10.5	10.6	0.1	Negligible	Negligible	Not significant
01-C-H041	Alsager Road, Hassall Green	17.2	17.6	0.4	Negligible	Negligible	Not significant
01-C-H042	Warmingham Road, Crewe	10.4	10.6	0.2	Negligible	Negligible	Not significant
01-C-H044	Middlewich Road, Bradfield Green	12.2	12.5	0.3	Negligible	Negligible	Not significant
01-C-H046	Brookhouse Road, Sandbach	11.5	11.6	0.1	Negligible	Negligible	Not significant
01-C-H047	Warmingham CofE Primary, Warmingham	10.5	10.6	0.1	Negligible	Negligible	Not significant
01-C-H048	London Road, Elworth	11.7	11.8	0.1	Negligible	Negligible	Not significant
01-C-H049	Middlewich Road, Minshull Vernon	11.3	11.3	<0.1	Negligible	Negligible	Not significant
01-C-H120	Crewe Road, Willaston	10.8	10.9	0.1	Negligible	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	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2026 without the AP2 revised scheme	2026 with the AP2 revised scheme				
01-C-H001	A500, Shavington Bypass, Willaston	7.3	7.4	0.1	Negligible	Negligible	Not significant
01-C-H002	Casey Lane, Basford	6.0	6.1	0.1	Negligible	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	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2026 without the AP2 revised scheme	2026 with the AP2 revised scheme				
01-C-H004	The B5338 Crewe Road, Willaston	7.0	7.0	<0.1	Negligible	Negligible	Not significant
01-C-H005	A500, Shavington Bypass, Weston	7.3	7.4	0.1	Negligible	Negligible	Not significant
01-C-H006	Barthomley Road, Barthomley	7.2	7.3	0.1	Negligible	Negligible	Not significant
01-C-H008	Middlewich Road, A51, Woolstanwood	7.4	7.4	<0.1	Negligible	Negligible	Not significant
01-C-H009	Crewe Green Roundabout, Crewe	7.9	7.9	<0.1	Negligible	Negligible	Not significant
01-C-H014	Sydney Road, Crewe	7.6	7.7	0.1	Negligible	Negligible	Not significant
01-C-H015	Sydney Road, Crewe	7.5	7.5	<0.1	Negligible	Negligible	Not significant
01-C-H017	Remer Street, Crewe	7.9	7.9	<0.1	Negligible	Negligible	Not significant
01-C-H022	Clay Lane, Haslington	7.1	7.3	0.2	Negligible	Negligible	Not significant
01-C-H030	Maw Lane, Haslington	6.7	6.8	0.1	Negligible	Negligible	Not significant
01-C-H034	Hassall Road, Day Green	7.7	7.8	0.1	Negligible	Negligible	Not significant
01-C-H035	B5076, Bradfield Road, Crewe	7.2	7.3	0.1	Negligible	Negligible	Not significant
01-C-H039	B5076, Bradfield Road, Crewe	8.2	8.3	0.1	Negligible	Negligible	Not significant
01-C-H040	Parkers Road, Crewe	6.9	7.0	0.1	Negligible	Negligible	Not significant
01-C-H041	Alsager Road, Hassall Green	10.6	10.8	0.2	Negligible	Negligible	Not significant
01-C-H042	Warmingham Road, Crewe	6.7	6.8	0.1	Negligible	Negligible	Not significant
01-C-H044	Middlewich Road, Bradfield Green	7.4	7.5	0.1	Negligible	Negligible	Not significant
01-C-H046	Brookhouse Road, Sandbach	7.5	7.5	<0.1	Negligible	Negligible	Not significant
01-C-H047	Warmingham CofE Primary, Warmingham	6.6	6.7	0.1	Negligible	Negligible	Not significant
01-C-H048	London Road, Elworth	7.5	7.6	0.1	Negligible	Negligible	Not significant
01-C-H049	Middlewich Road, Minshull Vernon	7.0	6.9	<0.1	Negligible	Negligible	Not significant

Receptor	Description/Location	$PM_{2.5}$ concentrations (µg/m³)		Change in $PM_{2.5}$ concentrations (µg/m³)	Impact descriptor	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2026 without the AP2 revised scheme	2026 with the AP2 revised scheme				
01-C-H120	Crewe Road, Willaston	6.9	7.0	0.1	Negligible	Negligible	Not significant

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

Ecological site	Sensitive habitat	Distance to road (m)	NOx concentrations (µg/m³)		Change in NOx concentrations (µg/m³)	Comparison against air quality standard (30µg/m³)	Percent change in relation to air quality standard
			2028 without the AP2 revised scheme	2028 with the AP2 revised scheme			
Oakhanger Moss SSSI/ Midland Meres and Mosses Phase 2 Ramsar site	Hydrological buffer woodland	122	15.3	17.2	1.9	Within standard	6.3%
	Hydrological buffer woodland	155	14.1	15.7	1.6	Within standard	5.2%
	Lowland raised bog	200	13.0	14.2	1.2	Within standard	4.1%

Table 18: Predicted annual mean of ammonia (NH_3) concentrations at ecological sites (construction phase)

Ecological site	Sensitive habitat	Distance to road (m)	NH_3 concentrations (µg/m³)		Change in NH_3 concentrations (µg/m³)	Comparison against critical level (1µg/m³ for low and 3µg/m³ high vegetation)	Percent change in relation to critical level
			2028 without the AP2 revised scheme	2028 with the AP2 revised scheme			
Oakhanger Moss SSSI/ Midland Meres and Mosses Phase 2 Ramsar site	Hydrological buffer woodland	122	5.1	5.3	0.2	Above standard	17.7%
	Hydrological buffer woodland	155	5.0	5.1	0.1	Above standard	14.6%
	Lowland raised bog	200	4.9	5.0	0.1	Above standard	11.5%

Table 19: Assessment of N deposition with ammonia at ecological sites (construction phase)

Ecological Site	Sensitive habitat	Distance to road (m)	Dry deposition (kg N/ha/yr)		Change in N deposition (kg N/ha/yr)	Lower Critical Load (kg N/ha/yr)	Percent change in relation to lower critical load
			2028 without the AP2 revised scheme	2028 with the AP2 revised scheme			
Oakhanger Moss SSSI/ Midland Meres and Mosses Phase 2 Ramsar site	Hydrological buffer woodland	122	62.4	64.0	1.6	10	16.7%
	Hydrological buffer woodland	155	61.3	62.7	1.4	10	13.8%
	Lowland raised bog	200	60.3	61.3	1.0	5	21.7%

Table 20: Assessment of acid deposition with ammonia at ecological sites (construction phase)

Ecological Site	Sensitive habitat	Distance to road (m)	Total acid deposition (k eq/ha/yr)		Change in acid deposition (k eq/ha/yr)	Change in acid deposition as percent of CLNmax	With AP2 revised scheme acid deposition as percent of CLNmax
			2028 without the AP2 revised scheme	2028 with the AP2 revised scheme			
Oakhanger Moss SSSI/ Midland Meres and Mosses Phase 2 Ramsar site	Hydrological buffer woodland	122	4.6	4.7	0.1	12.0%	475.6%
	Hydrological buffer woodland	155	4.5	4.6	0.1	10.0%	465.9%
	Lowland raised bog	200	4.4	4.5	0.1	13.5%	787.3%

4.3.9 The annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are predicted to be within the air quality standards during construction of the AP2 revised scheme. Since the annual mean NO_2 concentrations are predicted to be well below 60µg/m³, the hourly mean standard is also expected to be met. Similarly, since the annual mean PM_{10} concentrations are predicted to be below 35µg/m³, the daily mean standard is also expected to be met.

4.3.10 Negligible or slight impacts are predicted at all human receptors for annual mean NO_2 concentrations. Negligible impacts are predicted at all human receptors in the area for PM_{10} and $PM_{2.5}$ concentrations.

4.3.11 NOx concentrations at the Oakhanger Moss SSSI/Midland Meres and Mosses Phase 2 Ramsar site are predicted to be within the air quality standard with or without the AP2 revised scheme and the changes in NOx concentrations are greater than 1% of the air quality standard.

4.3.12 NH_3 concentrations at the Oakhanger Moss SSSI/Midland Meres and Mosses Phase 2 Ramsar site are predicted to be above the relevant critical level with or without the AP2 revised scheme, and the changes in NH_3 concentrations are greater than 1% of the air quality critical level.

4.3.13 The change in nitrogen deposition due to the AP2 revised scheme is predicted to be greater than 1% of the lower critical load.

4.3.14 The change in acid deposition due to the AP2 revised scheme is predicted to be greater than 1% of the maximum nitrogen critical load.

Assessment of significance

4.3.15 No significant effects are anticipated at any receptors in relation to NO_2, PM_{10} or $PM_{2.5}$ concentrations. There are no new or different significant effects from the construction of the AP2 revised scheme compared to the main ES as amended by SES1 and AP1 ES for human receptors.

4.3.16 Since the change in NOx concentrations is predicted to be greater than 1% of the air quality standard there is the potential for significant effects to occur at Oakhanger Moss SSSI/Midland Meres and Mosses Phase 2 Ramsar site due to NOx concentrations.

4.3.17 Since the change in NH_3 concentrations is predicted to be greater than 1% of the air quality critical level there is the potential for significant effects to occur at Oakhanger Moss SSSI/Midland Meres and Mosses Phase 2 Ramsar site due to NH_3 concentrations.

4.3.18 Since the change in N deposition is predicted to be greater than 1% of the lower critical load, there is the potential for significant effects to occur at Oakhanger Moss SSSI/Midland Meres and Mosses Phase 2 Ramsar due to N deposition.

4.3.19 Since the change in acid deposition is predicted to be greater than 1% of the maximum critical load, there is the potential for significant effects to occur at Oakhanger Moss SSSI/Midland Meres and Mosses Phase 2 Ramsar site up to 200 metres from the road.

4.3.20 There is the potential for new significant effects from the construction of the AP2 revised scheme compared to the main ES as amended by SES1 and AP1 ES at Oakhanger Moss SSSI/Midland Meres and Mosses Phase 2 Ramsar site for NOx concentrations, ammonia concentrations, nitrogen and acid deposition.

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 2039 were used as the operational year of the AP2 revised scheme.

Screening of traffic data

4.4.2 The screening process identified one road in the Hough to Walley's Green (MA01) community area exceeding the thresholds for changes in annual average daily traffic or daily heavy duty vehicle flows and/or changes in road alignment by 5m or more. This is the A530 Middlewich Road.

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 Details of the assessed receptors and the background concentrations used in the assessment remain as reported within the main ES as amended by SES1 and AP1 ES. There are no changes to the receptors reported in the main ES. Details of the assessed human receptors and the background concentrations used in the assessment are shown in Table 21. The location of all receptors is shown in the accompanying SES2 and AP2 ES Volume 5 Air quality Map Book: Map Series AQ-01- Monitoring Locations and Receptors.

4.4.5 No designated ecological receptors were identified within 200m of the screened in roads within the Hough to Walley's Green (MA01) community area during operation of the AP2 revised scheme.

Table 21: Modelled human receptors and background concentrations (operational phase)

Receptor	Description/Location	Ordnance Survey coordinates	Background concentrations in 2039 (µg/m^3)			
			NOx	NO_2	PM_{10}	$PM_{2.5}$
01-O-H001	Middlewich Road, Occleston	368335, 361931	8.1	6.4	9.7	6.0

Assessment results

4.4.6 Table 22 to Table 24 provide the summary of the modelled pollutant concentrations for the assessed human receptors. The magnitude of change and impact descriptor are provided along with a comparison against the main ES as amended by SES1 and AP1 ES. These were derived following the IAQM/EPUK methodology[8].

Table 22: 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	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2039 without the AP2 revised scheme	2039 with the AP2 revised scheme				
1-O-H001	Middlewich Road, Occleston	12.8	11.7	-1.1	Negligible	Negligible	Not significant

Table 23: 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	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2039 without the AP2 revised scheme	2039 with the AP2 revised scheme				
1-O-H001	Middlewich Road, Occleston	11.0	10.8	-0.2	Negligible	Negligible	Not significant

Table 24: Predicted annual mean $PM_{2.5}$ concentrations and impacts (operation phase)

Receptor	Description/Location	$PM_{2.5}$ concentrations (µg/m³)		Change in $PM_{2.5}$ concentrations (µg/m³)	Impact descriptor	Impact descriptor in the main ES as amended by SES1 and AP1 ES	Significance
		2039 without the AP2 revised scheme	2039 with the AP2 revised scheme				
1-O-H001	Middlewich Road, Occleston	6.8	6.6	-0.2	Negligible	Negligible	Not significant

4.4.7 The annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are predicted to be within the air quality standards during operation of the AP2 revised scheme. Since the annual mean NO_2 concentrations are predicted to be well below 60µg/m³, the hourly mean standard is also expected to be met. Similarly, since the annual mean PM_{10} concentrations are predicted to be below 35µg/m³, the daily mean standard is also expected to be met.

4.4.8 Negligible impacts are predicted at all human receptors in the area for annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations.

Assessment of significance

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

4.4.10 There are no new or different significant effects from the operation of the AP2 revised scheme compared to the main ES as amended by SES1 and AP1 ES. It should be noted that while the AP1 amendments have been included, these AP1 amendments have not been approved.

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