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Air Quality Assessment of Emissions to Atmosphere from Envision AESC UK Ltd Giga 1 Car Battery Manufacturing Facility, Sunderland

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1	10/08/23	Jacob Owen	Process Engineer

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Appendix 2 - Detailed Air Quality Modelling and Assessment Report

1 Introduction

An Air Quality Assessment (AQA) is required to support an application for an Environmental Permit (EP) for the proposed Envision AESC UK Ltd Giga 1 Factory in Washington, Sunderland.

The proposed Giga 1 factory will need a Part A(2) Environmental Permit (EP) from Sunderland District Council under the Local Authority Integrated Pollution Prevention and Control (LAIPPC) regulations, which cover what are known as A2 installations.

An Environment Agency (EA) H1 assessment of emissions from the proposed Giga factory was undertaken to determine which pollutants could be screened out as insignificant. The H1 assessment (**Appendix 1**) considers four pollutants from 36 volatile organic carbon (VOC) vents and six boilers.

The H1 assessment concluded that emissions could not be screened out as insignificant and that detailed modelling was required.

Detailed modelling has been undertaken by Wardell Armstong LLP and is presented as **Appendix 2** of this report.

This report provides an overview of the detailed modelling and assessment and includes the following appendices:

- Appendix 1: H1 Assessment Report
- Appendix 2: Detailed Air Quality Modelling and Assessment Report

About the Author

This air quality assessment and report was prepared by David Harvey, MBA BSc FIAQM, who has 30 years of experience in air quality. Mr Harvey is a Fellow of the Institute of Air Quality Management (FIAQM). Fellowship is for 'professionals who have had a distinguished career in the field of air quality'.

2 Environmental Agency (EA) H1 Assessment

2.1 Introduction

This section presents an overview of the H1 assessment.

The four pollutants included in the H1 assessment are:

- Oxides of nitrogen (NO_x) / nitrogen dioxide (NO_2)
- N-Methyl-2-Pyrrolidone (NMP)
- Ethylene Carbonate (EC)
- Diethyl Carbonate (DEC)

A copy of the H1 assessment report is provided in **Appendix 1**.

2.2 Conclusion of the H1 Assessment

The principal conclusions of the H1 assessment are:

'The H1 assessment for the Gaga factory shows that the long-term and short-term impacts of the four pollutants cannot be screened out as insignificant; therefore, detailed dispersion modelling is required.'

The report also states:

'It should be noted that the failure to screen out the pollutants as having an insignificant impact does not mean that the impacts are necessarily significant.'

3 Detailed Modelling and Assessment

3.1 Introduction

This section presents an overview of the detailed modelling and assessment for the proposed Envision AESC UK Ltd Giga 1 car battery manufacturing facility, Washington, Sunderland.

3.2 Air Quality Assessment (AQA)

Wardell Armstong LLP updated their June 2021 air quality assessment with an Addendum to the air quality assessment submitted to support the planning application for the new facility. The June 2023 assessment is Chapter 6 of the Addendum to the Environmental Statement (ES) and a copy of this is provided as **Appendix 2** of this report.

The Wardell Armstong assessment includes an assessment of road traffic emissions and construction impacts which are irrelevant to the permit application.

Of relevance to the permit application is the operational phase process emissions to the atmosphere.

The Wardell Armstrong assessment (**Appendix 2**) of emissions to air from the proposed installation has considered the following sources:

- Six stacks associated with the boilers.
- Twenty-one stacks associated with possible N-Methyl-2-Pyrrolidone (NMP) emissions.
- Ten stacks associated with possible Ethyl Carbonate (EC) emissions.
- Five stacks associated with possible Diethyl Carbonate Solvent Vapour (DEC) emissions.

The five pollutants included in the detailed assessment are:

- Oxides of Nitrogen (NO_x)/Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)
- N-Methyl-2-Pyrrolidone (NMP)
- Ethylene Carbonate (EC)
- Diethyl Carbonate (DEC)

Modelling and assessment were undertaken for eleven sensitive human receptors and 27 ecological receptors.

Dispersion modelling was undertaken using the AERMOD dispersion model and five years of hourly meteorological data from Newcastle Airport. The modelling includes the effects of building downwash and terrain.

Concerning impacts on human health, **Paragraph 6.5.30** of the detailed assessment state:

*'Taking into account the PC (and for long term emissions, the PEC), the overall air quality impact is classed as a Negligible or Slight Adverse, in accordance with the IAQM guidance, resulting in an overall **Not Significant** effect.'*

Concerning impacts on ecological sites, **Paragraph 6.5.43** of the detailed assessment state:

*'NO_2 emissions are considered to be **Not Significant** at the designated habitat sites considered (in accordance with EA guidance)'*

Paragraph 6.10.5 of the detailed assessment summarises the findings of the detailed assessment.

'A detailed assessment has also been undertaken to consider the potential for air quality effects arising as a result of emissions from the battery manufacturing processes that will take place at the site. The assessment concludes that there will be a Negligible to Slight Adverse (Not Significant) effect for nearby existing sensitive human receptors, and a Negligible (Not Significant) effect for the closest existing sensitive ecological receptor points. No significant cumulative impacts on air quality have been identified.'

To assist in preparing the permit for the proposed installation, **Table 3.1** shows the pollutant emissions concentrations used in the H1 and detailed assessment and are also the proposed emission limits for the Environmental Permit (EP).

Table 3.1 Pollutant Emission Concentration and Proposed Environmental Permit Emission Limits (mg Nm^{-3})

Source	Oxides of Nitrogen (NO_x)	Carbon Monoxide (CO)	N-Methyl-2-Pyrrolidone (NMP)	Ethyl Carbonate (EC)	Diethyl Carbonate (DEC)
Boiler Stack (1 of 6)	100	20	-	-	-
VOC 1-7	-	-	2	-	-
VOC 8-9	-	-	-	15	-
VOC 10	-	-	-	15	-
VOC 11	-	-	-	15	-
VOC 12-14	-	-	-	-	20
VOC 15	-	-	-	-	20
VOC 16-19	-	-	2	-	-
VOC 20-23	-	-	2	-	-
VOC 24-27	-	-	-	15	-
VOC 28	-	-	-	15	-
VOC 29	-	-	-	15	-
VOC 30	-	-	-	-	20
VOC 31	-	-	2	-	-
VOC 32	-	-	2	-	-
(a) Corrected for temperature: 273 K.					

4 Summary and Conclusions

An Air Quality Assessment (AQA) suitable to support an application for an Environmental Permit (EP) for the proposed Envision AESC Giga Factory, Washington, Sunderland has been completed.

The proposed Giga 1 factory will need a Part A(2) Environmental Permit (EP) from Sunderland District Council under the Local Authority Integrated Pollution Prevention and Control (LAIPPC) regulations, which cover what are known as A2 installations.

The Environment Agency (EA) H1 assessment outcome was that detailed modelling was required.

The conclusion of the detailed modelling undertaken is that the impacts are 'Not Significant 'and, therefore, not of concern to human health or ecology.

The detailed modelling was undertaken assuming continuous emissions at the concentrations shown in **Table 3.1,** which are the proposed emission limits for the Environmental Permit (EP).

Appendix 1 – H1 Assessment Report

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H1 Assessment of Emissions to Atmosphere from Envision AESC UK Ltd Giga 1 Car Battery Manufacturing Factory, Sunderland

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Emissions to Atmosphere from Envision AESC UK Ltd Giga 1 Car Battery Manufacturing Factory,

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1 Introduction

A H1 assessment of emissions to the atmosphere from the proposed Envision AESC UK Ltd Giga 1 car battery manufacturing Factory, Washington, Sunderland is required to inform an environmental permit application for the new facility.

The proposed Giga 1 factory will need a Part A(2) Environmental Permit (EP) from Sunderland District Council under the Local Authority Integrated Pollution Prevention and Control (LAIPPC) regulations, which cover what are known as A2 installations.

The H1 assessment considers four pollutants for 36 volatile organic carbon (VOC) vents and six boiler flues.

This report provides the required H1 assessment for emissions to the atmosphere.

About the Author

This air quality assessment and report was prepared by David Harvey, MBA BSc FIAQM, who has 30 years of experience in air quality. Mr Harvey is a Fellow of the Institute of Air Quality Management (FIAQM). Fellowship is for 'professionals who have had a distinguished career in the field of air quality'.

2 Data Requirements for H1 Assessment

2.1 Introduction

This section presents the data required for the H1 assessment.

2.2 Pollutants

The four pollutants included in the H1 assessment are:

- Oxides of nitrogen (NOx)/nitrogen dioxide (NO2)
- N-Methyl-2-Pyrrolidone (NMP)
- Ethylene Carbonate (EC)
- Diethyl Carbonate (DEC)

2.3 Assessment Criteria

The nitrogen dioxide (NO_2) assessment levels are the limit values included in the Air Quality Standards Regulations 2010 (1).

No assessment criteria are available for N-Methyl-2-Pyrrolidone (NMP), Ethylene Carbonate (EC) or Diethyl Carbonate (DEC). Therefore, these substances are conservatively assessed as being 100% benzene (C_6H_6).

Table 2.1 shows the Environment Assessment Levels (EAL) used in this H1 assessment.

Table 2.1 Air Quality Standards Regulations 2010 Limit Values; Environmental Assessment Level (EAL)

Substance	Averaging time	Environmental Assessment Level (EAL, $\mu g\ m^{-3}$)
Nitrogen dioxide (NO_2)	Annual mean	40
	99.8th percentile of hourly means	200
N-Methyl-2-Pyrrolidone (NMP), Ethylene Carbonate (EC) and Diethyl Carbonate (DEC) as Benzene (C_6H_6)	Annual mean	5
	24-hour mean	30

2.4 Significance Criteria

The Environment Agency's (EA) H1 risk assessment guidance includes a two-stage test to screen out impacts that are insignificant ( ).

(1) www.legislation.gov.uk/uksi/2010/1001/schedule/2/made.

The impacts are defined in terms of:

- Process Contribution (PC)
- Predicted Environmental Concentration (PEC)

The process contribution (PC) is the contribution from the installation. The predicted environmental concentration (PEC) is the process contribution (PC) added to the prevailing background concentration.

Stage 1:

The Environment Agecny (EA) guidance states that the process contribution (PC) can be considered as insignificant if both of the following are achieved:

- The long-term PC is <1% of the long-term Environmental Assessment Level (EAL); and
- The short-term PC is < 10% of the short-term Environmental Assessment Level (EAL)

The Environment Agency (EA) guidance states:

If you meet both of these criteria, you don't need to do any further assessment of the substance. If you don't meet them, you need to carry out a second stage of screening to determine the impact of the PEC.

Stage 2:

The Environment Agency (EA) guidance states that detailed modelling of emissions is needed for emissions that do not meet both of the following requirements:

- The long-term PEC is less than 70% of the long-term EAL; and
- The short-term PC is less than 20% of the short-term EAL minus twice the long-term background concentration

2.5 Estimated Background Concentrations

The Department for Environment, Food and Rural Affairs (Defra) provides estimates of the background concentrations for several pollutants for many years on a 1 km grid resolution for the whole of the UK. The Ordnance Survey (OS) grid reference closest to the location of the installation is 433500,559500.

Table 2.2 summarises the relevant annual average background pollutant concentrations used in this H1 assessment.

Table 2.2 Estimated Annual Average Background Pollutant Concentrations

Pollutant	Background Concentration	Unit	Data Source
Nitrogen dioxide (NO_2)	10.8	$\mu g\ m^{-3}$	Defra 2023 estimate
Benzene (C_6H_6)	0.50	$\mu g\ m^{-3}$	Defra 2010 estimate

2.6 Emissions Data

Table 2.3 shows the parameters which describe the physical properties of emissions from the proposed Giga factory, as required by the H1 assessment.

Table 2.3 Emissions and Physical Properties

Number [(a)]	Flue Height (m)	Height above Building (m)	Diameter (m)	Temp. (deg C)	Velocity (m s^{-1})	Flow (Am^3 hr^{-1})	Flow (Am^3 s^{-1})	Flow (Nm^3 s^{-1})[(a)]
B1-6	36	5.185	0.447	125	12.0	6,660	1.85	1.27
V1-7	33	3	0.45	20	18.0	10,080	2.80	2.61
V8	33	3	0.45	20	18.0	10,080	2.80	2.61
V9	33	3	0.45	20	18.0	10,080	2.80	2.61
V10	33	3	0.30	20	17.9	4,564	1.27	1.18
V11	33	3	0.41	20	16.0	7,560	2.10	1.96
V12-14	33	3	0.40	20	19.0	8,460	2.35	2.19
V15	33	3	0.45	20	18.0	10,432	2.90	2.70
V16-19	33	3	0.46	20	19.0	11,379	3.16	2.95
V20-23	33	3	0.45	20	18.0	10,080	2.80	2.61
V24-27	33	3	0.46	20	19.0	11,376	3.16	2.94
V28	33	3	0.30	20	16.0	4,082	1.13	1.06
V29	33	3	0.28	20	18.0	4,082	1.13	1.06
V30	33	3	0.28	20	18.0	4,082	1.13	1.06
V31	33	3	0.37	20	17.0	6,624	1.84	1.71
V32	33	3	0.26	20	18.0	3,358	0.93	0.87
V33-36	33	3	0.46	20	19.0	11,376	3.16	2.94

(a) B1-B6 are boilers, and V1-36 are VOC vents.
(b) Corrected for: temperature; 273 K.

Table 2.4 shows each source's pollutant emission concentration (mg Nm^{-3}) and pollutant emission rate (g s^{-1}). It should be noted that the emissions rates (g s^{-1}) are per flue/vent. For example, the emissions rate for the oxides of nitrogen (NO_x) from each of the six boiler flues is 0.063 g s^{-1}. The total emission rate from the six boilers is therefore 0.38 g s^{-1}.

Table 2.3 Pollutant Emission Concentration (mg Nm^{-3}) and Emission Rate (g s^{-1}) [a]

Number [b]	NO_x (mg Nm^{-3})	NMP (mg Nm^{-3})	EC (mg Nm^{-3})	DEC (mg Nm^{-3})	NOx (g s^{-1})	NMP (g s^{-1})	EC (g s^{-1})	DEC (g s^{-1})
B1-6	50	-	-	-	0.063	-	-	-
V1-7	-	2	-	-	-	0.005	-	-
V8	-	-	15	-	-	-	0.039	-
V9	-	-	15	-	-	-	0.039	-
V10	-	-	15	-	-	-	0.018	-
V11	-	-	15	-	-	-	0.029	-
V12-14	-	-	-	20	-	-	-	0.044
V15	-	-	-	20	-	-	-	0.054
V16-19	-	2	-	-	-	0.006	-	-
V20-23	-	2	-	-	-	0.005	-	-
V24-27	-	-	15	-	-	-	0.044	-
V28	-	-	15	-	-	-	0.016	-
V29	-	-	15	-	-	-	0.016	-
V30	-	-	-	20	-	-	-	0.021
V31	-	2	-	-	-	0.003	-	-
V32	-	2	-	-	-	0.002	-	-
V33-36	-	2	-	-	-	0.006	-	-

(a) Corrected for: temperature; 273 K.
(b) B1-B6 are boilers, and V1-36 are VOC vents.

3 H1 Assessment

3.1 Introduction

This section presents the results of the H1 assessment for the proposed Envision AESC UK Ltd Giga 1 car battery manufacturing factory, Washington, Sunderland.

3.2 H1 Assessment

Table 3.1 shows the results of the H1 assessment for the Giga factory.

Appendix A provided screenshots of the assessment results from the Environment Agency's H1 database tool.

Table 3.1 H1 Assessment of Envision AESC Giga Factory, Washington, Sunderland

Description	Source			
	Boilers		VOC Vents	
Flue height (m)	36		33	
Number of sources	6		36	
Height above building (m)	5.185		3.0	
Effective height (m)	8.6		5.0	
Dispersion factor Long-term (μg m^{-3} per g s^{-1})	48		90	
Dispersion factor Short-term (μg m^{-3} per g s^{-1})	1,045		2,240	
	Nitrogen dioxide (NO_2)	**NMP (as Benzene)**	**EC (as Benzene)**	**DEC (as Benzene)**
Process contribution (PC) Long-term (μg m^{-3})	18.3 (a)	9.9	30.0	18.6
Process contribution (PC) Short-term (μg m^{-3})	199 (b)	145 (c)	441 (c)	273 (c)
EAL Long-term (μg m^{-3})	40		5	
EAL Short-term (μg m^{-3})	200		30	
PC as Percentage of EAL Long-term (%)	46%	197%	601%	372%
PC as Percentage of EAL Short-term (%)	99%	483%	1470%	910%
State One: Screening Test				
Long-Term PC > 1% of EAL	Yes	Yes	Yes	Yes
Short-Term PC > 10% of EAL	Yes	Yes	Yes	Yes
PEC Long-term (μg m^{-3}) (d)	29.1	10.4	30.5	19.1
PEC as Percentage of EAL Long-Term (%)	73%	207%	611%	382%
PC Short-term as %age of (EAL-2xbackground)	111%	500%	1521%	941%
State Two: Screening Test				
Long-term PEC > 70% of EAL	Yes	Yes	Yes	Yes
Short-term PC > 20% of headroom (e)	Yes	Yes	Yes	Yes

(a) Long-term emission assumes 100% of NO_x is NO_2.
(b) Short-term emissions assume 50% of NO_x is NO_2.
(c) A factor of 0.59 was used to convert the hourly average to the 24-hour average.
(d) Assumes background of 10.8 μg m^{-3} for NO_2 and 0.5 μg m^{-3} for benzene.
(e) Short-term headroom is short-term EAL – twice the long-term background.

The H1 assessment for the Giga factory presented in **Table 3.1** shows that the long-term and short-term impacts of the four pollutants cannot be screened out as insignificant; therefore, detailed dispersion modelling is required.

It should be noted that the failure to screen out the pollutants as having an insignificant impact does not mean that the impacts are necessarily significant.

The following are two examples of how H1 is deliberately conservative in its approach:

- H1 assumes that the maximum process contribution (PC) from each vent/flue occurs at the same ground-level location. For short-term impacts, H1 also assumes that maximum hourly average process contributions (PC) occur for the same hour of the year and at the same location for each release point.

- H1 takes account of the height of the release above the building but not the actual release height above ground-level. This is a very conservative assumption for this assessment, given that the VOC vents are 33 m above ground-level and the boiler flues are 36 m.

Detailed dispersion modelling accounts for the actual release height and determines the process contribution (PC) from each source separately to allow the cumulative impacts to be calculated.

Appendix A -

Screen Shots from Environment Agency H1 Tool (For the Six Boilers, Nitrogen Dioxide, NO_2)

Air Release Points

Please define your Release Points for Releases to Air

Are there any Air emissions? Yes — Click the Add button below

Number	Description	Location or Grid Reference	Activity or Activities	Effective Height (metres)	Efflux Velocity (m/s)	Total Flow (m3/hr)
e.g.	A1	North stack		150	25	5,000
1	B1			8.6	12	4572
2	B2			8.6	12	4572
3	B3			8.6	12	4572
4	B4			8.6	12	4572
5	B5			8.6	12	4572
6	B6			8.6	12	4572

Note: flow rate used is Nm3/hr to allow H1 to calculate the correct emission rate (g/s)

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Air Emissions Inventory

Please list all Substances released to Air for each Release Point identified in the previous page.

Number	Substance	Meas'ment Method	Operating Mode (% of Year)	Data relating to Long Term effects: Conc. (mg/m3)	Release Rate (g/s)	Meas'ment Basis	Data relating to Short Term effects: Conc. (mg/m3)	Release Rate (g/s)	Meas'ment Basis	Annual Rate (tonne/yr)	ELV Conc. (mg/m3)
e.g.	sulphur dioxide	Estimated*	70% load	1510	3000	annual avg	1510	3000	hourly avg	55,000	2000
1	Nitrogen Dioxide	Continuo	100.0%	50.0	0.063500		25.0	0.031750		2.0025	

Note: short-term NOx emission conc. of 25 mg/Nm3 was used to allow for the assumption of 50% oxidation.

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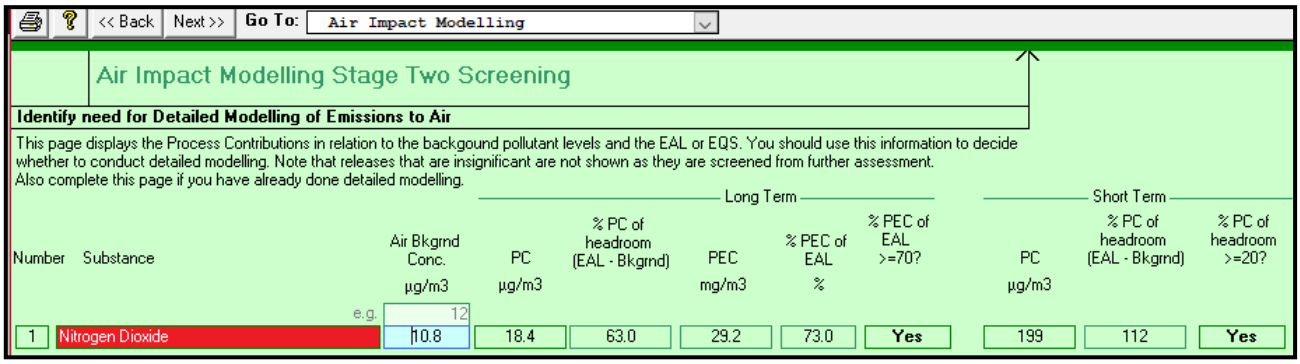
Air Impact Screening Stage One

Screen out Insignificant Emissions to Air

This page displays the Process Contribution as a proportion of the EAL or EQS. Emissions with PCs that are less than the criteria indicated may be screened from further assessment as they are likely to have an insignificant impact.

Number	Substance	Long Term EAL (µg/m3)	Short Term EAL (µg/m3)	Long Term: PC (µg/m3)	Long Term: % PC of EAL	Long Term: > 1% of EAL?	Short Term: PC (µg/m3)	Short Term: % PC of EAL	Short Term: > 10% of EAL?
1	Nitrogen Dioxide	40.0	200	18.4	46.0	Yes	199	99.6	Yes



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Air Impact Modelling Stage Two Screening

Identify need for Detailed Modelling of Emissions to Air

This page displays the Process Contributions in relation to the backgound pollutant levels and the EAL or EQS. You should use this information to decide whether to conduct detailed modelling. Note that releases that are insignificant are not shown as they are screened from further assessment.
Also complete this page if you have already done detailed modelling.

Number	Substance	Air Bkgrnd Conc. µg/m3	Long Term PC µg/m3	Long Term % PC of headroom (EAL - Bkgrnd)	Long Term PEC mg/m3	Long Term % PEC of EAL %	Long Term % PEC of EAL >=70?	Short Term PC µg/m3	Short Term % PC of headroom (EAL - Bkgrnd)	Short Term % PC of headroom >=20?
	e.g.	12								
1	Nitrogen Dioxide	10.8	18.4	63.0	29.2	73.0	Yes	199	112	Yes

Appendix 2 - Detailed Air Quality Modelling and Assessment Report

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Appendix 6.2 Methodology for Construction Phase Assessment

Appendix 6.3 Methodology for Operation Phase Assessment

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Appendix 6.5 Professional Experience of Assessors

6 AIR QUALITY

6.1 Introduction & background

6.1.1 This chapter of the addendum ES assesses the potential effects of the proposed development of IAMP ONE Phase Two site (the site) on air quality. It addresses the effects of the variation application and 3 standalone applications as described in chapter 3.

6.1.2 The proposed revised development at IAMP ONE Phase Two includes the removal of the existing topsoil within the site, in order to facilitate the development of the site as part of the wider IAMP area, and the construction of the new battery manufacturing facility. The construction works have been completed and the soils have already been stripped. There are no vehicle generation increases arising from IAMP ONE Phase Two variation.

6.1.3 The IAMP ONE Phase Two Development planning application (ref. no. 20/00556/OU4) was submitted to Sunderland City Council (SCC) in March 2020 and planning consent was granted in June 2020. Subsequent to receiving planning consent, however, amendments to the scheme design were proposed that necessitated the submission of a new planning application – known as the revised IAMP ONE Phase Two Development planning application now approved. (Reference 21/01764/HE4).

6.1.4 Additional amendments to the scheme design have since been proposed; thereby necessitating the submission of a Section 73[1] application. This ES Chapter Addendum reflects the changes made to the scheme as part of these amendments and an assessment of the potential air quality impacts associated with them.

6.1.5 There will be emissions associated with the battery manufacturing processes taking place within the proposed revised development. A number of processes will result in emissions to air.

6.1.6 This ES addendum chapter details the results of an air quality screening assessment, which considers the potential disamenity dust effects and fine particulate matter arising during the construction phase of the development. A qualitative discussion of air quality emissions arising from vehicular generation during the operational phase is also included and the assessment considers the findings from a previous air quality

[1] Of the Town and Country Planning Act 1990.

assessment undertaken as part of the wider IAMP ONE consent[2]. Finally, a detailed assessment, comprising air dispersion modelling, has also been undertaken to consider emissions to air from the revised proposed battery manufacturing processes.

6.2 Consultation and scope of the assessment

6.2.1 Informal consultation with Sunderland City Council (SCC) suggested that an air quality assessment be included within the EIA for the site, and that it should include modelling of stack emissions connected to the industrial processes. Sensitive receptors to be affected by the construction activities are outlined in Table 6.2. These are the same as application reference 21/01764/HE4.

6.2.2 The air quality effects of the operational phase were assessed as part of the wider IAMP ONE consent, although this did not consider any emissions to air from the proposed battery manufacturing processes. Owing to the reasons outlined in the introductory Chapters, the original outline application did not include the triangle of land forming the south-western part of the site (the location of the former West Moor Farm). For air quality (and transport), however the assessment considered the entirety of IAMP ONE as being operational. Consequently, vehicle generation and the subsequent impacts this may have had on air quality have already been accounted for and modelled as part of the outline May 2018 Air Quality Environment Statement[1], prepared by Golder Associates. The air quality effects of the operational phase were also assessed as part of the 2020 IAMP ONE Phase Two consent. Compared to the previous two assessments, however, it is known that there will be fewer vehicle movements in relation to the operation of the current proposed development.

6.2.3 The demolition of West Moor Farm has taken place and provides land in excess of what was previously assessed in the May 2018 report[1], but this additional land will not result in a net increase in vehicle generation (rather, it is anticipated that vehicles movements will reduce for the proposed development approved as part of reference permission 21/01764/HE4). Consequently, all vehicle generation arising from IAMP ONE has already been assessed[1].

6.2.4 North Moor Farm is situated approximately 170m to the north. These buildings are now being used by Morgan & Sindall, the contractor who is currently progressing the diversion of the power lines. At the time of the previous air quality assessment for the

[2] Planning application ref. 18/00092/HE4

revised IAMP ONE Phase Two application, these buildings were not owned by IAMP and were therefore included in the assessment as a possible sensitive receptor. These buildings are now under the ownership of the IAMP LLP, and therefore, North Moor Farm has not been considered as a sensitive receptor within this updated assessment.

6.3 Methodology

Legislation, policy context & literature review

Relevant Air Quality Legislation & Guidance

6.3.1 The air quality assessment has been undertaken in accordance with the following legislation and guidance:

- The Environment Act 1995, as amended 2021.
- Department of Environment, Food and Rural Affairs, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, July 2007.
- The Air Quality Standards Regulations 2010.
- Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance LAQM.TG(22), August 2022.
- Ministry of Housing, Communities and Local Government, National Planning Policy Framework, July 2021.
- Department for Communities and Local Government, Planning Practice Guidance: Air Quality, November 2019.
- Institute of Air Quality Management, Guidance on the Assessment of Dust from Demolition and Construction v1.1, July 2016.
- Environmental Protection UK and Institute of Air Quality Management, Land-Use Planning and Development Control: Planning for Air Quality v1.2, January 2017.
- Institute of Air Quality Management, A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites v1.1, May 2020., now demolished
- Environment Agency, Air Emissions Risk Assessment for Your Environmental Permit, August 2016 (updated March 2023).
- Environment Agency, Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, March 2014.
- Conservation Agencies' Guidance on Evaluating Model Impacts Against Critical

Loads.

6.3.2 Further details of these documents are included in Appendix 6.1.

Construction phase impacts

6.3.3 To assess the impacts associated with dust and fine particulate matter releases during the construction phase of the development, an assessment has been undertaken in accordance with guidance from the Institute of Air Quality Management (IAQM)[3]. Further details of the construction assessment methodology are provided in Appendix 6.2.

6.3.4 One ecological sensitive receptor has been identified within 350 m of the site. There are no human sensitive receptors within 350m of the site. . The ecological receptor is the ecological and landscape mitigation area (ELMA), which borders to the land to the north of IAMP ONE. The land is not currently an ecological designation and, therefore, it would typically be assigned a low sensitivity in accordance with the IAQM Construction Guidance criteria. However, in recognition of the ELMA (and Green Belt) status of this land, a medium sensitivity is assigned to this area for the purposes of this assessment.

6.3.5 A summary of the closest sensitive receptors in relation to where construction phase activities will take place is detailed in Table 6.1.

Table 6.1: Closest Existing Sensitive Receptors to Construction Phase Activities

Receptor	Direction from the Site	Approximate distance to the closest on-site operation (m)*
ELMA	North and west	Adjacent to site boundary
*Construction vehicles are expected to travel onto the A1290 and toward the A19(T). There are no sensitive receptors located on this route, within 50 m of the roadside at a distance of up to 500m from the construction site entrance		

6.3.6 The criteria used to assess the construction impact of the proposed development, and the associated significance of effects at existing sensitive receptors, are included in Appendix 6.2.

Operational phase impacts

Road Traffic Emissions

6.3.7 A discussion of the potential impact, as a result of road traffic emissions, during the

[3] Institute of Air Quality Management, Guidance on the Assessment of Dust from Demolition and Construction v1.1, July 2016

operational phase is outlined in this ES Chapter for permission reference 21/01764/HE4. Reference is made to the findings of the previous ES for IAMP ONE prepared by Golder Associates[1] ,the 2020 ES for IAMP ONE Phase two and the 2021 ES for the revised IAMP ONE Phase two application. A review of the most recent air quality information is included in this chapter, as well as a discussion regarding vehicle-derived air quality impacts. As such, the previous two assessments constitute a worst-case scenario.

Process Emissions

6.3.8 With regard to emissions to air resulting from the proposed battery manufacturing processes, this was considered within the 2021 ES. However, material amendments have been made to the scheme since this assessment was undertaken. Therefore, an updated detailed assessment has been undertaken to consider the potential for air quality impacts as a result of emissions to air.

6.3.9 Potential emissions to atmosphere have been modelled using AERMOD (Lakes Environmental model version 11.2). This is a proprietary quantitative atmospheric dispersion model that is based upon the Gaussian theory of plume dispersion.

6.3.10 The dispersion modelling has been carried out in accordance with guidance from the IAQM[4] and the Environment Agency (EA) guidance on carrying out risk assessments for environmental permits[5].

6.3.11 The assessment of emissions to air from the manufacturing processes has considered the following sources:

- 6 No. stacks associated with the boilers.
- 21 No. stacks associated with possible N-Methyl-2-Pyrrolidone (NMP) emissions.
- 10 stacks associated with possible Ethyl Carbonate (EC) emissions.
- 5 stacks associated with possible Diethyl Carbonate Solvent Vapour (DEC) emissions.

6.3.12 Further details of the sources considered in the air quality assessment, and the modelling methodology, are provided in Appendix 6.3.

[4] Moorcroft and Barrowcliffe et al, Land-Use Planning and Development Control: Planning for Air Quality (v1.2), January 2017
[5] Environment Agency, Air emissions risk assessment for your environmental permit, March 2023 [Accessed at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit]

6.3.13 Details of the existing sensitive human receptors considered in the assessment of emissions to air are included in Table 6.2.

Table 6.2: Closest Existing Sensitive Human Receptors to Proposed Development

Receptor	Location		Direction from the Site	Approximate Distance to Site (m)
	X	Y		
ESR 1	433348	559511	North	610
ESR 2	433325	559682	North	780
ESR 3	433964	559014	East	570
ESR 4	434421	559599	North East	1,250
ESR 5	434628	559171	East North East	1,240
ESR 6	434701	558784	East	1,235
ESR 7	432334	557787	South West	1,120
ESR 8	431864	558150	West South West	1,305
ESR 9	431633	558997	West North West	1,450
ESR 10	431811	559418	North West	1,415
ESR 11	432337	559965	North North West	1,410

6.3.14 In addition, the EA guidance on carrying out risk assessments for environmental permits advises that the following screening distances apply to statutory designated habitat sites (referred to in the guidance as 'protected conservation areas') (see Figure 8.2):

- 10 km from a site (or 15 km for Part A(1) processes): Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites.
- 2 km from a site: Sites of Special Scientific Interest (SSSI) and local nature sites (including Ancient Woodland, Local Wildlife Sites (LWS), National Nature Reserves (NNR) and Local Nature Reserves (LNR)).

6.3.15 These screening distances are reiterated in the IAQM guidance on assessing air quality impacts on designated habitat sites[6].

6.3.16 Four statutory habitat sites have been identified within these distances (15 km has been assumed as a worst-case approach):

- Barmston Pond LNR, approximately 1,175 m to the south south west, at the closest point
- Hylton Dene LNR, approximately 1,530 m to the east south east, at the closest point. The Hylton Dene LWS and Tilesheds LWS are also located within the

[6] Institute of Air Quality Management, A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites v1.1, May 2020

boundary of this LNR.

- Durham Coast SAC, approximately 7,600 m to the east north east, at the closest point.
- Northumbria Coast Ramsar site/SPA, approximately 7,275 m to the east, at the closest point.

6.3.17 In addition to the statutory sites listed above, it has been possible to identify two further existing LWSs, and three candidate LWSs, located within a 2km radius of the site:

- Severn Houses LWS, approximately 880 m to the south west.
- High Wood LWS, approximately 1,700 m to the south.
- River Don candidate LWS, approximately 580 m to the north.
- Usworth Burn (River Don South) candidate LWS, approximately 520m to the north.
- Elliscope Farm East/Hylton Bridge candidate LWS, approximately 620 m to the north.

6.3.18 No detailed habitat information is available on the online MAGIC resource[7] for the River Don or Usworth Burn candidate LWSs so full assessment of these cannot be included.

6.3.19 Details of the existing sensitive ecological receptor points considered in the assessment of emissions to air are included in Table 6.3.

Table 6.3: Closest Existing Sensitive Ecological Receptors to Proposed Development

Designated Site	Receptor Point	Location	
		X	Y
Barmston Pond LNR	ECO 1	432898	557317
	ECO 2	432826	557377
	ECO 3	432757	557436
	ECO 4	432502	557295
	ECO 5	432526	556917
Hylton Dene LNR (including Hylton Dene and Tilesheds LWSs)	ECO 6	434998	558111
	ECO 7	434977	558286
	ECO 8	434991	558395
	ECO 9	435179	558458

[7] Accessed at: https://magic.defra.gov.uk/MagicMap.aspx

Table 6.3: Closest Existing Sensitive Ecological Receptors to Proposed Development			
Designated Site	**Receptor Point**	**Location**	
		X	**Y**
	ECO 10	435395	558651
Northumbria Coast Ramsar site/SPA	ECO 11	442469	550558
Northumbria Coast Ramsar site/SPA and Durham Coast SAC	ECO 12	442020	551558
	ECO 13	441510	553317
	ECO 14	441266	554722
Northumbria Coast Ramsar site/SPA	ECO 15	440691	559575
	ECO 16	440654	559929
Northumbria Coast Ramsar site/SPA and Durham Coast SAC	ECO 17	440766	561003
	ECO 18	440853	561335
	ECO 19	441075	561641
	ECO 20	441256	562268
	ECO 21	441306	562877
Durham Coast SAC	ECO 22	441068	563824
	ECO 23	439916	564875
	ECO 24	438341	566409
Northumbria Coast Ramsar site/SPA	ECO 25	437290	567782
	ECO 26	436692	568865
	ECO 27	435756	572415

6.3.20 The existing and candidate LWSs have not been considered as specific receptor points in the assessment but they are located within the area covered by the Uniform Cartesian Grid included in the dispersion model. High Wood LWS is not located within the grid area and therefore the highest results from the nearby Barmston Ponds LNR have been used, as a robust approach.

Assessment criteria

6.3.21 The relevant air quality objectives and limit values applicable to the assessment of air quality effects at existing sensitive human receptors are set out in Table 6.4, below.

6.3.22 The battery manufacturing processes taking place at the site will make use of three different types of solvent: N-Methyl-2-Pyrrolidone (NMP).Ethyl Carbonate (EC) and Diethyl Carbonate (DEC). There are no specific air quality objectives or Environmental Assessment Levels (EALs) for these solvents and, therefore, they have been considered as total Volatile Organic Compounds (VOCs), with predicted concentrations compared against the air quality objective for Benzene (C_6H_6).

Table 6.46: Air Quality Objectives and Limit Values Relevant to the Assessment*			
Pollutant	**Objective/Limit Value**	**Averaging Period**	**Obligation**
Nitrogen Dioxide (NO_2)	200µg/m^3, not to be exceeded more than 18 times a year	1-hour mean	All local authorities
	40µg/m^3	Annual mean	All local authorities
Particulate Matter (PM_{10})	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	England, Wales and Northern Ireland
	40µg/m^3	Annual mean	England, Wales and Northern Ireland
Particulate Matter ($PM_{2.5}$)	Limit Value of 25µg/m^3	Annual mean	England, Wales and Northern Ireland
Carbon Monoxide (CO)	10mg/m^3	Maximum daily running 8-hour mean	England, Wales and Northern Ireland
Benzene (C_6H_6)	5µg/m^3	Annual mean	England and Wales
**In accordance with the Air Quality Standards Regulations 2010*			

6.3.23 Modelled airborne pollutant concentrations and deposition rates, at locations within relevant statutory designated habitat sites, have been assessed against critical levels and critical loads respectively.

6.3.24 The relevant critical levels used in the assessment of air quality effects, associated with airborne pollutant concentrations, at existing sensitive ecological receptor points are included within Table 6.5.

Table 6.56: Critical Levels Relevant to the Assessment			
Pollutant	**Objective/Limit Value**	**Averaging Period**	**Obligation**
Nitrogen Oxide (as NO_2)	75µg/m^3	24-hour mean	All local authorities
	30µg/m^3	Annual mean	All local authorities

6.3.25 Nitrogen Dioxide (NO_2) is a nitrogen containing pollutant and its deposition to ground can promote eutrophication and acidification. Both eutrophication and acidification can cause substantial alterations in soil chemistry (including nutrient status) and plant community composition. Critical loads define the maximum amount of an atmospheric pollutant that can be deposited onto soils, waters or vegetation without causing adverse harmful effects in the long term.

6.3.26 Site relevant critical loads for nutrient nitrogen and acid deposition have been obtained for the SPAs and SACs from the Air Pollution Information System (APIS) online resource[8].

6.3.27 As specific values are not provided for LNRs and LWSs, the APIS 'Search by Location' tool has been used to derive critical loads for the location of each LNR and LWS considered. The lowest value has been used for each LNR and LWS to provide a conservative assessment.

6.3.28 Further details of the critical loads used in the assessment are provided in Table 6.6.

Table 6.66: Critical Loads Relevant to the Assessment

Designated Site	Sensitive Feature	Relevant Nitrogen Critical Load (kgN/ha/yr) / Habitat	Nitrogen-Derived Acid Deposition Critical Load (kEq/ha/year)
Barmston Pond Local Nature Reserve (LNR)	Broadleaved, Mixed and Yew Woodland	10	CLminN: 0.357 CLmaxN: 2.733
Hylton Dene Local Nature Reserve (LNR)	Broadleaved, Mixed and Yew Woodland	10	CLminN: 0.357 CLmaxN: 2.73
Durham Coast Special Area of Conservation (SAC)	Vegetated sea cliffs of the Atlantic and Baltic Coasts	No comparable habitat with established critical load available	Not sensitive
Northumbria Coast Ramsar site/Special Protection Area (SPA)	Sternea paradisea/ Sterna albifrons (little tern)	5	MinCLminN: 0.856 MinCLmaxN: 4.856
High Wood Local Wildlife Site (LWS)	Broadleaved, Mixed and Yew Woodland	10	CLminN: 0.357 CLmaxN: 2.734
Severn Houses Local Wildlife Site (LWS)	Coniferous Woodland	5	CLminN: 0.357 CLmaxN: 2.733
Elliscope Farm East/Hylton Bridge candidate Local Wildlife Site (LWS)	Broadleaved, Mixed and Yew Woodland	10	CLminN: 0.357 CLmaxN: 2.729

[8] [Accessed at: http://www.apis.ac.uk/]

6.3.29 As there are no established critical loads for the sensitive feature within Durham Coast SAC, and no features sensitive to acid deposition, this designated site has not been considered further within the assessment.

6.3.30 In addition, it has not been possible to obtain any detailed information about the habitats within the two candidate LWSs.

6.3.31 The EA guidance states that emissions can be screened out, for Ramsar sites/SPAs/SACs and SSSIs, where the following criteria apply:

- The short-term Process Contribution (PC) is less than 10% of the short-term environmental standard for protected conservation areas.
- The long-term PC is less than 1% of the long-term environmental standard for protected conservation areas.

6.3.32 Where these requirements are not met, the Predicted Environmental Concentration (PEC) should be calculated for long-term concentrations only and should be compared against the above criteria. If the long-term PC is greater than 1%, but the PEC is less than 70% of the long-term environmental standard, the emissions are considered not significant.

6.3.33 For local nature sites (such as LNRs and LWSs), emissions can be screened out where both of the following criteria apply:

- The short-term PC is less than 100% of the short-term environmental standard.
- The long-term PC is less than 100% of the long-term environmental standard.

6.3.34 Should these criteria be exceeded, it does not necessarily follow that there will be a consequent significant ecological effect; rather it indicates the potential for such an effect to occur.

6.4 Baseline situation

Background air pollutant concentrations

6.4.1 The air quality assessment needs to take into account background concentrations upon which emissions from the proposed development are superimposed.

6.4.2 As there are currently no representative NO_2, PM_{10} or $PM_{2.5}$ monitoring locations in the vicinity of the proposed development site, background concentrations have been obtained from the 2018-based Defra default concentration maps for the appropriate

grid squares[9].

6.4.3 In addition, background CO and C_6H_6 concentrations have been obtained from the 2001-based Defra default concentration maps for the appropriate grid squares[10]. These have been adjusted to 2021 using the associated adjustment factors provided by Defra in the Background Concentration Maps User Guide[11].

6.4.4 The background pollutant concentrations used in the assessment of air quality impacts at existing sensitive human receptors are detailed in Table 6.7.

Table 6.7: Background Pollutant Concentrations used in the Air Quality Assessment

Receptor	2023 Annual Mean Concentrations (µg/m³)					
	Oxides of Nitrogen (NO_x)	Nitrogen Dioxide (NO_2)	Fine Particulate Matter (PM_{10})	Fine Particulate Matter ($PM_{2.5}$)	Carbon Monoxide (CO)	Benzene (C_6H_6)
ESR 1	14.37	10.85	11.79	6.68	0.093	0.48
ESR 2	14.37	10.85	11.79	6.68	0.093	0.48
ESR 3	14.37	10.85	11.79	6.68	0.093	0.48
ESR 4	19.56	14.34	12.57	7.41	0.091	0.43
ESR 5	19.56	14.34	12.57	7.41	0.091	0.43
ESR 6	33.75	22.33	12.63	7.70	0.092	0.43
ESR 7	17.68	13.04	12.47	6.93	0.094	0.44
ESR 8	17.56	12.97	10.31	6.43	0.093	0.48
ESR 9	17.56	12.97	10.31	6.43	0.093	0.48
ESR 10	14.02	10.61	11.30	6.54	0.092	0.47
ESR 11	13.32	10.13	12.24	6.72	0.092	0.47

6.4.5 Background pollutant concentrations at and in the vicinity of the proposed development are well below the relevant air quality objectives/limit values.

6.4.6 Current pollutant concentrations and deposition rates at the considered designated habitat sites have been taken from the APIS resource and are shown in Table 6.8.

Table 6.86: Current Air Pollutant Conditions at the Considered Designated Habitat Sites

Designated Site	Nitrogen Deposition (kg N/ha/yr)	Acid Deposition (Nitrogen, keq/ha/yr)	NO_x Concentration (µg/m³)
Barmston Pond Local Nature Reserve (LNR)	24.64	1.76	21.73
Hylton Dene Local Nature Reserve (LNR)	25.62	1.83	23.01

[9] Accessed through the Defra Local Air Quality Management webpages [http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html]
[10] Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2001
[11] Available at: https://laqm.defra.gov.uk/documents/2018-based-background-maps-user-guide-v1.0.pdf

Table 6.86: Current Air Pollutant Conditions at the Considered Designated Habitat Sites			
Designated Site	**Nitrogen Deposition (kg N/ha/yr)**	**Acid Deposition (Nitrogen, keq/ha/yr)**	**NO_x Concentration ($\mu g/m^3$)**
Northumbria Coast Ramsar site/Special Protection Area (SPA)	7.1	0.51	6.32
High Wood Local Wildlife Site (LWS)	24.64	1.76	18.84
Severn Houses Local Wildlife Site (LWS)	24.64	1.76	21.73
Elliscope Farm East/Hylton Bridge candidate Local Wildlife Site (LWS)	24.64	1.76	17.52

Sunderland city council & local pollution review

6.4.7 The proposed revised development is located on land to the north of the A1290, north of the existing Nissan manufacturing plant, surrounded by arable farming land and the under-development IAMP ONE site. There are no significant sources of pollution near the site, however the A19(T) is located approximately 1.4 km to the east.

6.4.8 There are no air quality monitors operated by SCC in the vicinity of the site and no air quality monitoring was undertaken as part of the IAMP ONE submission.

6.4.9 For the preparation of the Preliminary Environmental Information Report (which has been prepared to accompany the IAMP TWO Development Consent Order (DCO) application (with the DCO application having now been withdrawn)), air quality monitoring has been undertaken by the Applicant. A 9-month monitoring study was completed at 9 locations in the local area (near and around the A1290 and A19), and data has been annualised. Of most relevance to this assessment are diffusion tubes 1 and 2, which are located at the A1290, at West Moor Farm and near Downhill Lane which is the closest monitoring location to the site. Annualised 2018 NO_2 concentrations were 22.10$\mu g/m^3$ and 20.80$\mu g/m^3$ respectively. However West Moor Farm is no longer a residential receptor.

6.5 Assessment of effects

Construction phase

Step 1 – Requirement for Detailed Construction Phase Assessment

6.5.1 There are sensitive receptors located within 350 m of the future construction activities. The requirement for a detailed construction phase risk assessment is met.

6.5.2 The IAMP ONE outline submission[1] includes sensitive receptors around the entirety of the red line boundary. It is, therefore, anticipated that the permitted dust mitigation scheme will already account for risks higher than those predicted in this assessment.

6.5.3 The demolition of North Moor Farm has not yet taken place, however, as this land is now under the IAMP LLP ownership, there is no risk the site will be placed in to residential use again and so this has not been included in the assessment.

Step 2 – Impact Assessment

6.5.4 In accordance with the IAQM guidance, the main activities to be considered during the construction phase of the proposed development are earthworks, construction and trackout. There are no demolition activities associated with the proposed development.

6.5.5 Earthworks covers the processes of soil-stripping, ground-levelling, excavation and landscaping. Earthworks also encompasses any material handling activities that may be required either during the working of the surfaces or by unloading/loading activities.

6.5.6 Construction activities will focus on the construction of proposed buildings, access roads and car parking areas. This includes the foundation design and casting concrete.

6.5.7 Trackout is defined as the transport of dust and dirt by vehicles travelling from a construction site on to the public road network. This may occur through the spillage of dusty materials onto road surfaces or through the transportation of dirt by vehicles that have travelled over muddy ground on the site. This dust and dirt can then be deposited and re-suspended by other vehicles.

Step 2A

6.5.8 Step 2A of the assessment defines the potential dust emission magnitude from earthworks, construction and trackout in the absence of site-specific mitigation. Examples of the criteria for the dust emission classes are detailed in Appendix 6.2. The results of this step are detailed in Table 6.9.

Step 2B

6.5.9 Step 2B of the construction phase dust assessment defines the sensitivity of the area, taking into account the significance criteria detailed in Appendix 6.2, for earthworks,

construction and trackout. The sensitivity of the area to each activity is assessed for potential dust soiling, human health effects and ecological effects.

6.5.10 For earthworks and construction, there are currently between 1 and 10 receptors within 350 m of where these activities may take place, which is assumed to be the site boundary for the purposes of this assessment. The ELMA is estimated to be located within 20 m of an earthwork activity but up to 50 m from a construction-specific activity.

6.5.11 For trackout, there are no sensitive receptors located within 50 m of where trackout may occur for a distance of up to 500 m from the site entrance (assuming construction vehicles exit onto the A1290 and travel to the A19). Notwithstanding the IAQM Construction Guidance terminology, the sensitivity of the area is defined as medium.

Step 2C

6.5.12 Step 2C of the construction phase dust assessment defines the risk of impacts from each activity, by combining the dust emission magnitude with the sensitivity of the surrounding area.

6.5.13 The risk of dust impacts from each activity, with no mitigation in place, has been assessed in accordance with the criteria detailed in Appendix 6.2. The results of this step are detailed in Table 6.9.

Summary of Step 2

6.5.14 Table 6.9 details the results of Step 2 of the construction phase assessment for the sensitive receptors identified.

Table 6.9: Construction Phase Dust Assessment for Sensitive Receptors

	Activity			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Step 2A				
Dust Emission Magnitude	N/A	Large[a]	Large[b]	Large[c]
Step 2B				
Sensitivity of Closest Human Receptors	N/A	High	High	High
Sensitivity of Closest Ecological Receptors (ELMA)	N/A	Medium	Medium	Medium
Sensitivity of Area to Ecological Impacts	N/A	Medium	Low	Low
Sensitivity of Area to Dust Soiling Effects	N/A	Low	Low	Low

Table 6.9: Construction Phase Dust Assessment for Sensitive Receptors				
	Activity			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Sensitivity of Area to Human Health Effects	N/A	Low[d]	Low[d]	Low[d]
Step 2C				
Dust Risk: Dust Soiling	N/A	Low Risk	Low Risk	Low Risk
Dust Risk: Human Health	N/A	Low Risk	Low Risk	Low Risk
Dust Risk: Ecological	N/A	Medium Risk	Low Risk	Low Risk
a. Total site area estimated to be more than 10,000m² *b. Total building volume estimated to be more than100,000m³, with potentially dusty construction materials involved* *c. Number of construction phase vehicles estimated to be more than 50 movements per day (the IAMP ONE Phase One submission estimates up to 84 movements per day)* *d. Background annual mean PM_{10} concentration is taken from the LAQM Defra default concentration maps, for the appropriate grid square for 2023*				

Operational phase

Road traffic emissions

6.5.15 The proposed development does not introduce any new vehicle flows.

6.5.16 The IAMP ONE submission[1] included an operational phase assessment of vehicle generation, using the detailed modelling software ADMS-Roads. The assessment predicted air quality pollutant (NO_2, PM_{10} and $PM_{2.5}$) concentrations at various sensitive receptor locations and for a proposed 2020 future operational year. The scope of study covered the main road network to be utilised by the development (this included the A1290, A19, A1231 and A184).

6.5.17 The air quality assessment predicted negligible air quality changes and that pollutant concentrations would be below the air quality objectives and limit values in all scenarios considered.

6.5.18 The additional extent of development land included as part of this submission is not expected to result in significant effects or even any changes to those conclusions predicted previously, in terms of air quality.

Process Emissions

Existing Sensitive Human Receptors

6.5.19 NO_x and CO concentrations, as a result of the operation of the steam-generating boilers and LTHW boilers have been modelled at a number of existing human and

ecological sensitive receptors/receptor points, where applicable.

6.5.20 In addition, NMP,Ethyl Carbonate (EC) and Diethyl Carbonate (DEC) concentrations, as a result of the operation of the electrode manufacturing and electrolyte coating processes, have been modelled at a number of existing human sensitive receptors.

6.5.21 The predicted NO_x concentrations have been converted to NO_2 concentrations in line with EA recommendations.

6.5.22 The background concentrations of NO_2, detailed in Table 6.7, have been used to determine the PEC at each human receptor, for each year of meteorological data. The PC and PEC as a percentage of the relevant air quality objective have then been determined for each receptor, for each year of meteorological data.

6.5.23 The highest NO_2 concentrations/percentages, for the existing sensitive human receptors predicted to experience to highest PCs, are summarised in Table 6.10.

Table 6.10: Maximum Modelled NO_2 Concentrations for Existing Sensitive Human Receptors

Pollutant	AQO	ESR	PC	PEC	PC/AQO	PEC/AQO
NO_2 Annual Mean	40µg/m³	ESR 1 (Hylton Bridge Farm) and ESR 6 (Ferryboat Lane)	0.68µg/m³	22.62µg/m³	1.70%	56.56%
NO_2 1-hour Mean (99.8th Percentile)	200µg/m³, not to be exceeded more than 18 times a year	ESR 1 (Hylton Bridge Farm) and ESR 6 (Ferryboat Lane)	14.81µg/m³	50.11µg/m³	7.40%	25.05%

6.5.24 The background concentrations of CO, detailed in Table 6.7, have been used to determine the PEC at each human receptor, for each year of meteorological data. The PC and PEC as a percentage of the relevant air quality objective have then been determined for each receptor, for each year of meteorological data.

6.5.25 The highest CO concentrations/percentages, for the existing sensitive human receptors predicted to experience to highest PCs, are summarised in Table 6.11.

Table 6.11: Maximum Modelled CO Concentrations for Existing Sensitive Human Receptors

Pollutant	AQO	ESR	PC	PEC	PC/AQO	PEC/AQO
CO Maximum Daily Running 8-hour Mean	10mg/m³	ESR 1 (Hylton Bridge Farm)	0.0031mg/m³	0.1890mg/m³	0.0315%	1.89%

6.5.26 The background concentrations of C_6H_6, detailed in Table 6.7, have been used to determine the PEC at each human receptor, for each year of meteorological data. The PC and PEC as a percentage of the relevant air quality objective have then been

determined for each receptor, for each year of meteorological data.

6.5.27 The highest C_6H_6 concentrations/percentages, for the existing sensitive human receptors predicted to experience to highest PCs, are summarised in Table 6.12.

Table 6.12: Maximum Modelled NMP and Ethyl Carbonate (as C_6H_6) Concentrations for Existing Sensitive Human Receptors

Pollutant	AQO	ESR	PC	PEC	PC/AQO	PEC/AQO
NMP (as C_6H_6) Annual Mean	5µg/m³	ESR 1 (Hylton Bridge Farm)	0.123µg/m³	0.60µg/m³	2.46%	11.97%
Ethyl Carbonate (as C_6H_6) Annual Mean	5µg/m³	ESR 1 (Hylton Bridge Farm)	0.31µg/m³	0.78µg/m³	6.10%	15.61%
Diethyl Carbonate (as C_6H_6) Annual Mean	5µg/m³	ESR 3 (Washington Road)	0.40 µg/m³	0.87 µg/m³	7.94%	17.45%

6.5.28 The results confirm that the maximum modelled PCs and PECs do not exceed the relevant air quality objectives for any of the existing sensitive human receptors considered in the assessment (i.e. ESR 1 to ESR 11).

6.5.29 In addition, the potential air quality effect at the existing sensitive human receptors has been assessed in accordance with the impact descriptors within the IAQM Air Quality and Planning guidance (as included in Table 6.1/2 in Appendix 6.1). This allows the significance of the impact to be determined.

6.5.30 Taking into account the PC (and for long term emissions, the PEC), the overall air quality impact is classed as a Negligible or Slight Adverse, in accordance with the IAQM guidance, resulting in an overall **Not Significant** effect.

6.5.31 The modelled pollutant concentrations for the considered receptors, along with the Cartesian grid point(s) experiencing the maximum modelled concentrations, are detailed in Appendix 6.4.

Existing sensitive ecological receptor points

6.5.32 In-line with the EA guidance, the short-term and long-term PCs have been compared against the relevant critical levels. The PC values, as a percentage of the relevant critical level, have been determined for each receptor point considered, for each year of meteorological data.

6.5.33 Short-term and long-term PCs have been predicted at the existing sensitive ecological receptor points. The highest NO_2 concentrations/percentages are summarised in Table 6.13.

Table 6.13: Maximum Modelled NO_2 Concentrations for Existing Sensitive Ecological Receptor Points				
Pollutant	**Critical Level**	**Habitat Site**	**PC**	**PC as % of Critical Level**
NO_2 Annual Mean	30µg/m³	Barmston Pond Local Nature Reserve (LNR)	0.11µg/m³	0.37%
		Hylton Dene Local Nature Reserve (LNR)	0.20µg/m³	0.66%
		Northumbria Coast Ramsar site/Special Protection Area (SPA)	0.03µg/m³	0.10%
		High Wood Local Wildlife Site (LWS)	0.11µg/m³	0.37%
		Severn Houses Local Wildlife Site (LWS)	0.12µg/m³	0.41%
		Elliscope Farm East/Hylton Bridge candidate Local Wildlife Site (LWS)	0.36µg/m³	1.21%
NO_2 24-hour Mean[a]	75µg/m³	Barmston Pond Local Nature Reserve (LNR)	3.91µg/m³	5.21%
		Hylton Dene Local Nature Reserve (LNR)	2.91µg/m³	3.88%
		Northumbria Coast Ramsar site/Special Protection Area (SPA)	0.30µg/m³	0.40%
		High Wood Local Wildlife Site (LWS)	3.91µg/m³	5.21%
		Severn Houses Local Wildlife Site (LWS)	2.78µg/m³	3.70%
		Elliscope Farm East/Hylton Bridge candidate Local Wildlife Site (LWS)	3.32µg/m³	4.43%
[a] Worst-case conversion from NO_x to NO_2 applied (100%) to provide a conservative approach				

6.5.34 The results confirm that the maximum modelled PCs do not exceed 100% of the short-term or long-term critical levels, for the protection of vegetation, for any of the modelled receptor points within the nearby LNRs or (candidate) LWSs.

6.5.35 In addition, the results confirm that the maximum modelled PCs do not exceed 10% of the short-term nor 1% of the long-term critical levels, for the protection of vegetation, for any of the modelled receptor points within the Northumbria Coast Ramsar site/SPA.

6.5.36 It is, therefore, not necessary to proceed to a comparison of PECs against the critical levels, as NO_2 emissions are considered to be Not Significant at the designated habitat sites considered (in accordance with EA guidance).

6.5.37 The maximum modelled nutrient nitrogen and acid deposition rates, due to emissions from the battery manufacturing processes, are detailed in Table 6.14.

Table 6.14: Maximum Modelled Deposition Rates for Nutrient Nitrogen and Acid at Existing Sensitive Ecological Receptor Points

Designated Habitat Site	Highest Modelled Nutrient Nitrogen Deposition Rate PC (kgN/ha/yr)	Highest Modelled Acid Deposition Rate PC (kEq/ha/yr)
Barmston Pond Local Nature Reserve (LNR)	0.032	0.002
Hylton Dene Local Nature Reserve (LNR)	0.057	0.004
Northumbria Coast Ramsar site/Special Protection Area (SPA)	0.004	0.0003
High Wood Local Wildlife Site (LWS)	0.032	0.002
Severn Houses Local Wildlife Site (LWS)	0.035	0.003
Elliscope Farm East/Hylton Bridge candidate Local Wildlife Site (LWS)	0.105	0.007

6.5.38 The process contribution to nutrient nitrogen deposition has been assessed as a percentage of the critical load. Nitrogen-derived acid deposition has been assessed in accordance with guidance published by APIS[12]. The guidance provided with this tool enables a calculation to be made of the contribution to acid deposition as a percentage of the relevant critical load value. This guidance advises:

"Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.

Where PEC N Deposition > CLminN.

*PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100"*

6.5.39 For this assessment, the PEC was greater than CLminN in every case and consequently the above calculation was used to calculate the PC as a percentage of the critical load function.

[12] Available on the APIS website [http://www.apis.ac.uk/clf-guidancel]

6.5.40 The results are presented in Table 6.15.

Table 6.15: Assessment of Maximum Modelled Deposition Rates, for Nutrient Nitrogen and Acid, Against Critical Loads

Designated Habitat Site	Nutrient Nitrogen Deposition		Acid Deposition	
	Critical Load (kgN/ha/yr)	Highest Modelled PC as % of Critical Load	Critical Load – MinCLmaxN (kEq/ha/yr)[a]	Highest Modelled PC as % of Critical Load
Barmston Pond Local Nature Reserve (LNR)	10	0.32%	2.733	0.08%
Hylton Dene Local Nature Reserve (LNR)	10	0.57%	2.73	0.15%
Northumbria Coast Ramsar site/Special Protection Area (SPA)	5	0.09%	4.856	0.01%
High Wood Local Wildlife Site (LWS)	10	0.32%	2.733	0.08%
Severn Houses Local Wildlife Site (LWS)	5	0.70%	2.733	0.09%
Elliscope Farm East/Hylton Bridge candidate Local Wildlife Site (LWS)	10	1.05%	2.729	0.27%

[a] *Lowest critical load applied*

6.5.41 The results confirm that the maximum modelled PCs, for both nutrient nitrogen and acid deposition, do not exceed 100% of the long-term critical loads, for the protection of vegetation, for any of the modelled receptor points within the nearby LNRs or (candidate) LWSs.

6.5.42 In addition, the results confirm that the maximum modelled PCs do not exceed 1% of the long-term critical loads, for the protection of vegetation, for any of the modelled receptor points within the Northumbria Coast Ramsar site/SPA.

6.5.43 It is not therefore necessary to proceed to a comparison of PECs against the critical loads, as NO_2 emissions are considered to be **Not Significant** at the designated habitat sites considered (in accordance with EA guidance).

6.5.44 The maximum modelled NO_2 concentrations/deposition rates, expressed as a proportion of the relevant critical levels and critical loads respectively, for the considered existing sensitive ecological receptor points are detailed in Appendix 6.5.

6.6 Mitigation measures

Construction phase

Step 3 – Mitigation

6.6.1 During the construction phase, the implementation of effective mitigation measures will substantially reduce the potential for nuisance dust and fine particulate matter to be generated, which can be secured by planning condition.

6.6.2 Step 2C of the assessment has identified that the risk of dust soiling, human health and ecological effects is not negligible for all the activities and therefore site-specific mitigation will need to be implemented to ensure dust effects from these activities will be Not Significant.

6.6.3 Best practice dust control measures are recommended and are set out in more detail in a Dust Management Plan (DMP), prepared as part of the Construction Environmental Management Plan (CEMP) for the site, in advance of development commencing. Condition 9 of the planning permission for the battery plant required the submission of a CEMP including a Dust Management Plan. The CEMP and Dust Management Plan were approved on 20 April 2022 (discharge of conditions application 22/00653/DIS)

6.6.4 Examples of typical dust controls, included in the Management Plan, are:

- Regular grading and maintenance of haul roads, if used within the site.
- Speed restrictions on vehicles within the site.
- Recording of all dust complaints and prompt action to address these, keeping a detailed written log of received information and complaints, and actions taken to resolve the situation.
- Provision of training to the onsite personnel on dust mitigation.
- Laden lorries to be covered before leaving the site.
- Provision of water bowsers to spray haul roads and stockpiles with water to suppress dust emissions, as necessary.
- Minimising of stockpiling heights, thereby reducing wind whipping and lofting.

Operational phase

Road traffic emissions

6.6.5 No additional mitigation above that required for IAMP ONE Phase One is deemed necessary, due to there being no prediction of significant effects. Mitigation measures required for IAMP ONE include a number of transport-related measures, including junction upgrades, traffic management improvements and a travel plan.

Process emissions

6.6.6 The results of the assessment confirm that the maximum modelled PCs and PECs do not exceed the relevant air quality objectives for any of the existing sensitive human receptors. The potential air quality effect is also considered to be Not Significant in accordance with the IAQM Air Quality and Planning guidance.

6.6.7 The results of the assessment also confirm that the maximum modelled PCs do not exceed the relevant screening criteria, for either critical levels or critical loads, for any of the modelled existing sensitive ecological receptor points considered in the assessment. The emissions from the modelled source are, therefore, not considered to be significant at any designated habitat sites assessed.

6.6.8 On this basis, it is considered that there will be sufficient dispersion of all pollutants considered, meaning further mitigation will not be required. It should also be noted that the proposed revised development will operate under an Environmental Permit, which will be regulated by either the Local Authority or the EA (dependent on the final details of the proposed manufacturing processes).

6.7 Residual effects

6.7.1 Residual effects are those effects of the revised development that remain after mitigation measures have been implemented. With the implementation of the measures set out in the DMP, residual effects are expected to be Negligible (**Not Significant**) for construction and operation.

6.8 Cumulative effects

Construction phase

6.8.1 The construction and working of land within the site will be completed as part of the construction of IAMP ONE. The identified committed developments requiring due consideration for cumulative effects will not cause adverse risks during their construction period, should this coincide with that of the site (i.e. increased disamenity dust and fine particulate matter releases) due to the distances between these developments and the site. No consideration of potential cumulative effects of

construction is, therefore. required for these.

6.8.2 Both IAMP ONE, this development and the future developments at IAMP TWO would all be worked in accordance with an approved CEMP. The approved CEMP for this development outlines an extensive list of mitigation ensuring that the potential for dust and fine particulate matter arising from construction activities are minimal and can be controlled.

Operational phase

Road traffic emissions

6.8.3 In relation to the cumulative effects associated with traffic generation and air quality, the outline submission[1] considered two committed developments within the traffic data modelled: Hillthorn Farm Commercial Park and Turbine Business Park. Owing to the low pollutant concentration predictions presented in the air quality report accompanying the 2018 outline submission, it is anticipated that any additional committed developments that might be considered would not change the overall conclusions of the assessment and would remain as Negligible and **Not Significant**. There is no additional vehicle generation arising from IAMP ONE Phase Two. Rather, vehicle movements are anticipated to reduce from those approved.

Process emissions

6.8.4 A review of nearby committed and proposed developments suggests that there are no known similar emission sources proposed in the local area other than the existing Nissan battery plant which is part of the baseline. The most relevant developments for consideration of cumulative effects are the IAMP One Phase 1 development, and further light industrial, general industrial and storage distribution units proposed at Hillthorn Farm (approximately 1.21 km to the south west of the site) and consented at Follingsbury International Enterprise Park (approximately 2.49 km to the north west).

6.8.5 Although these developments do include for light industrial, general industrial and distribution uses, these do not include for a manufacturing facility on the scale of that proposed for the IAMP One Phase 2 development. The use of NMP, Ethyl Carbonate and Diethyl Carbonate in particular is restricted to certain types of processes and therefore would be unlikely to be used in significant quantities elsewhere.

6.8.6 Given the distances involved between these sites, and the results of the air quality

assessment, it is considered extremely unlikely that any significant cumulative air quality effects will arise.

6.8.7 Full details of the nearby committed and proposed developments in the local area are provided in Table 2.5 of Chapter 2 of this ES.

6.9 Limitations of study

Road traffic emissions

6.9.1 There were no known limitations to this study.

6.9.2 As there will be no changes to the upper limit of forecast traffic generation considered for IAMP ONE, the findings of the 2018 assessment are considered still valid (details pertaining to traffic flows, trip generation and distribution, etc. are set out in the IAMP ONE ES and TA).

Process emissions

6.9.3 The air quality assessment considers a worst-case scenario in terms of the process emissions, both through the type and number of each source considered using maximum emission concentrations. This has been carried out in collaboration with the client and the technology suppliers for each stage of the process. It is, however, likely that the final design will result in changes to the precise configuration of the emission sources, although these are likely to only reduce in scale and not increase

6.9.4 Input information for the air dispersion model has been provided in good faith, based on assumptions about the proposed battery manufacturing process or from scaled-up data collected from the nearby existing plant. Maximum emission concentrations have been used as a worst-case assessment; however, actual concentrations are expected to be significantly lower. It is understood that further design work and process optimisation has not yet been completed to enhance VOC efficiency and it is likely that better capture/recycling processes will result in lower emissions than those that have been modelled.

6.9.5 The air quality assessment also adopts a conservative approach to try to address the uncertainties involved with atmospheric dispersion modelling. This approach includes:

- Using a worst-case conversion for NO_x to NO_2 concentrations (i.e. a 50% conversion rate for short-term concentrations and a 100% conversion rate for long-term concentrations).

- Applying the air quality objectives for Benzene to the NMP, EC and DEC modelled concentrations, which are considered overly robust as Benzene is one of the most toxic VOC's, in accordance with EA guidance.
- Running the model separately for the most recent five years of meteorological data, with the highest results presented.

6.9.6 As a result of these conservative inputs, the model is considered more likely to provide an overestimation of the potential air quality effects, associated with the sources at the proposed battery manufacturing plant, than an underestimation.

6.10 Summary and conclusions

6.10.1 An air quality assessment has been completed which considers the potential air quality effects of both the construction and operational phases of the IAMP ONE Phase Two development proposals.

6.10.2 A construction phase risk assessment has concluded that there is a risk of potential disamenity dust and fine particulate matter releases associated with the earthworks, construction and trackout activities during construction of the development. Mitigation to control and limit dust generation during construction are outlined in a CEMP, including a Dust Management Plan. These have been approved under a discharge of conditions application (22/00653/DIS). These measures are being implemented during the construction phase.

6.10.3 A qualitative review of the potential air quality effects relating to road traffic emissions during the operation of the proposed development has been undertaken. A review of the baseline indicates pollutant concentrations in the local area are well below the relevant air quality objectives and limit values.

6.10.4 All traffic arising from IAMP ONE has been assessed in the previous 2018 ES that was prepared by Golder Associates and the 2020 IAMP ONE Phase Two ES prepared by Wardell Armstrong. The planning application was granted, and the Air Quality Chapter concluded a Negligible (Not Significant) effect upon air quality. There are no vehicle increases proposed as part of this development and, therefore, there will be no adverse air quality changes arising. A Negligible (Not Significant) effect is predicted. No significant cumulative impacts on air quality have been identified.

6.10.5 A detailed assessment has also been undertaken to consider the potential for air quality effects arising as a result of emissions from the battery manufacturing

processes that will take place at the site. The assessment concludes that there will be a Negligible to Slight Adverse (Not Significant) effect for nearby existing sensitive human receptors, and a Negligible (Not Significant) effect for the closest existing sensitive ecological receptor points. No significant cumulative impacts on air quality have been identified.

6.10.6 The assessment conclusions do not differ from those for permission 21/01764/HEA.

APPENDIX 6.1: AIR QUALITY LEGISLATION AND GUIDANCE

National Air Quality Strategy

1.1 The Environment Act 1995, as amended 2021, requires the UK government to prepare a national Air Quality Strategy. The first UK strategy was published in March 1997, setting out policies for the management of ambient air quality. This was subsequently updated in 2007[1].

1.2 The 2007 strategy establishes the framework for air quality management in England, Scotland, Wales and Northern Ireland. Air quality standards and objectives are set out for eight pollutants which may potentially occur at levels that give cause for concern. The strategy also provides details of the role that local authorities are required to take in working towards improvements in air quality, known as the Local Air Quality Management (LAQM) regime.

Air Quality Standards and Objectives

1.3 Air quality standards and objectives are set out in the strategy for the following pollutants: nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), lead (Pb), fine particulate matter (PM_{10}), benzene (C_6H_6), 1, 3–butadiene (C_4H_6) and ozone (O_3).

1.4 Objectives for each pollutant, except O_3, were first given statutory status in the Air Quality (England) Regulations 2000[2] and Air Quality (England) (Amendment) Regulations 2002[3]. These objectives are defined in the strategy as:

"the maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale."

1.5 EU limit values, set out within the Ambient Air Quality Directive 2008/50/EC[4] (i.e. the CAFE Directive), were transposed into UK legislation on 11th June 2011 as The Air Quality Standards Regulations 2010. These are mostly the same as the air quality objectives in terms of concentrations; however, there are differences in determining how compliance is achieved. Although the UK is no longer part of the EU, no changes

[1] Department of Environment, Food and Rural Affairs, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007
[2] The Air Quality (England) Regulations 2000. SI No 928
[3] The Air Quality (Amendment) Regulations 2002
[4] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

have yet been made to the objectives and limit values used in the management and assessment of air quality.

1.6 Whilst there is no specific objective for $PM_{2.5}$ in England, a limit value of 20µg/m^3 is referred to in the regulations, which has been adopted for use in this assessment (as recommended by the LAQM Helpdesk). An objective has been set for $PM_{2.5}$ in Scotland since early 2016. The Environmental Improvement Plan 2023 sets an interim target that by January 2028, an annual average of 12 µg/m^3 for $PM_{2.5}$ is not exceeded by any monitoring station.

1.7 Examples of where these objectives and limit values apply are detailed in the Defra LAQM Technical Guidance document LAQM.TG(22)[5] and are included in Table 6.1/1.

Table 6.1/1: Examples of Where the Air Quality Objectives Should Apply

Averaging Period	Objectives Should Apply at:	Objectives Should Generally Not Apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes, etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens of residential properties [a]	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 and 8-hour objectives apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks and railway stations etc. which are not fully	Kerbside sites where public would not be expected to have regular access

[5] Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance LAQM.TG(22), August 2022

Table 6.1/1: Examples of Where the Air Quality Objectives Should Apply		
Averaging Period	**Objectives Should Apply at:**	**Objectives Should Generally Not Apply at:**
	enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend one hour or longer	
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer	
[a] *Such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure to pollutants would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied*		

Local Air Quality Management

1.8 LAQM legislation in the Environment Act 1995 requires local authorities to conduct the periodic review and assessments of air quality. These aim to identify all those areas where the objectives are being, or are likely to be, exceeded. Where exceedances are likely to occur, local authorities are required to declare an Air Quality Management Area (AQMA).

1.9 LAQM.TG(22) presents a streamlined approach for LAQM in England and Scotland; however, Northern Ireland is still considering changes to LAQM and therefore works according to the previous regime.

1.10 The Welsh Government amended the LAQM regime in Wales in 2017 by issuing new statutory policy guidance in order to bring the system into line with the Well-being of Future Generations (Wales) Act 2015[6]. This aims to achieve compliance with the national air quality objectives in specific hotspots and to reduce exposure to pollution more widely, so as to achieve the greatest public health benefit.

1.11 Local authorities in England are required to produce Annual Status Reports (ASRs), and in Scotland, Annual Progress Reports (APRs). These replace all other reports which previously had to be submitted including Updating and Screening Assessments, Progress Reports and Detailed Assessments (which would be produced to assist with

[6] Well-being of Future Generations (Wales) Act 2015 (anaw 2)

an AQMA declaration).

1.12 Local authorities now have the option of a fast-track AQMA declaration option. This allows more expert judgement to be used and removes the need for a Detailed Assessment where a local authority is confident of the outcome. Detailed Assessments should however still be used if there is any doubt.

1.13 As part of the UK Government's requirement to improve air quality, selected local authorities in England are also currently investigating the feasibility of setting up Clean Air Zones (CAZs). These are areas where targeted action and co-ordinated resources aim to improve air quality within an urban setting, in order to achieve compliance with the EU Limit Values within the shortest possible time.

1.14 The first CAZs were implemented in Bath in March 2021 and in Birmingham in June 2021. In addition, the London Ultra Low Emission Zone (ULEZ) will expand to incorporate the North and South Circular roads in October 2021. The Bristol CAZ became live in November 2022. The Newcastle-upon-Tyne and Gateshead CAZ became live in January 2023. The Sheffield CAZ became live in February 2023. Charges apply to certain types of vehicles travelling within these areas, including buses, coaches, taxis, private hire vehicles and heavy-duty vehicles (HDVs). The Greater Manchester CAZ, due to be introduced from 30 May 2022, has been delayed and is currently under review.

National Planning Policy Framework

1.15 The National Planning Policy Framework (NPPF)[7], introduced in March 2012, updated in February 2019 and then, most recently, in July 2021, requires that:

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of AQMAs and CAZs, and the cumulative impacts from individual sites in local areas.

Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications.

[7] Ministry of Housing, Communities and Local Government, National Planning Policy Framework, July 2021

Planning decisions should ensure that any new development in AQMAs and CAZs is consistent with the local air quality action plan."

Planning Practice Guidance

1.16 The Planning Practice Guidance (PPG)[8], updated in November 2019, states that whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impacts in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).

1.17 Where a proposed development is anticipated to give rise to concerns about air quality, an appropriate assessment needs to be carried out. Where the assessment concludes that the proposed development (including mitigation) will not lead to an unacceptable risk from air pollution, prevent sustained compliance with national objectives or fail to comply with the requirements of the Habitats Regulations, then the local authority should proceed to decision with appropriate planning conditions and/or obligations.

Sunderland City Council Clean Air Zone Planning Policy

1.18 At the time of writing, there are no specific clean air zone planning policies in the Sunderland area.

Institute of Air Quality Management – Guidance on the Assessment of Dust from Demolition and Construction

1.19 Guidance has been prepared by the Institute of Air Quality Management (IAQM)[9] with relation to the assessment of dust from demolition and construction. Further details on the assessment methodology are provided in Appendix 6.2**.**

Environmental Protection UK and Institute of Air Quality Management – Land-Use Planning and Development Control: Planning for Air Quality

1.20 Guidance has been prepared by Environmental Protection UK (EPUK) and the IAQM[10] with relation to the assessment of the air quality impacts of proposed developments

[8] Department for Communities and Local Government. Planning Practice Guidance: Air Quality, November 2019
[9] Institute of Air Quality Management, Guidance on the Assessment of Dust from Demolition and Construction v1.1, June 2016
[10] Moorcroft and Barrowcliffe et al, Land-Use Planning and Development Control: Planning for Air Quality v1.2, January 2017

and their significance.

1.21 The impact of a development is usually assessed at specific receptors, and takes into account both the long-term background concentrations, in relation to the relevant Air Quality Assessment Level (AQAL) at these receptors, and the change with the development in place.

1.22 The impact descriptors for individual receptors are detailed in Table 6.1/2.

Table 6.1/2: Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor in Assessment Year*	Percentage Change in Concentration Relative to Air Quality Assessment Level (AQAL)*			
	1%	2-5%	6-10%	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

**Percentage pollutant concentrations have been rounded to whole numbers, to make it easier to assess the impact. Changes of 0% (i.e. less than 0.5% or 0.2µg/m^3) should be described as Negligible*

1.23 Impacts on air quality, whether adverse or beneficial, will have an effect on human health that can be judged as either 'significant' or 'not significant'.

1.24 Once the impact of the proposed development has been assessed for the individual impacts, the overall significance is determined using professional judgement. This takes into account a number of factors such as:

- The existing and future air quality in the absence of the development;
- The extent of the current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

1.25 The guidance suggests that a negligible or slight adverse impact can usually be described as 'not significant'.

Institute of Air Quality Management – A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites

1.26 Guidance has been prepared by the IAQM with relation to the assessment of air

quality impacts on designated nature conservation sites[11]. For the assessment of point sources, such as stacks associated with industrial processes, this makes reference to the Environment Agency (EA) guidance on carrying out a risk assessment as part of an Environmental Permit application (including the screening distances for habitat sites and the criteria for screening out significant effects).

Environment Agency Guidance on Air Emissions Risk Assessments

1.27 The Environment Agency (EA) has produced guidance to support the completion of an air emissions risk assessment as part of Environmental Permit applications[12]. This sets out steps to be followed when carrying out a risk assessment, including defining when detailed atmospheric dispersion modelling is required as part of an Environmental Permit application. The document also sets out environmental benchmarks for a range of pollutants and the required contents of air dispersion modelling reports.

AQTAG06 – Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air

1.28 Guidance has been produced[13] to provide an overview of how a quantitative assessment (Stage 3 appropriate assessment) should be carried out, using short range modelling to consider emissions to air arising from an Environmental Permitting Regulations (EPR) process, to fulfil the requirements of the Habitats Regulations.

1.29 The guidance provides details of the different inputs required for a dispersion modelling exercise. In addition, it sets out recommended deposition velocities for both grassland and forest habitats, which are used in an assessment of nutrient nitrogen and acid deposition.

Guidance on Evaluating Model Impacts Against Critical Loads

1.30 A method for calculating exceedance of the acidity critical load function, and the contribution from a source to the critical load function, is provided on the Air Pollution Information System (APIS) website[14].

1.31 The critical load function, which was developed under the UNECE Convention on Long-

[11] Institute of Air Quality Management, A Guide to the Assessment of Air Quality Impacts at Designated Nature Conservation Sites v1.1, May 2020
[12] Environment Agency, Air emissions risk assessment for your environmental permit, March 2023 [Accessed at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit]
[13] Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air, AQTAG06, March 2014
[14] [Accessed at: http://www.apis.ac.uk/clf-guidance]

Range Transboundary Air Pollution (CLRTAP), defines combinations of sulphur and nitrogen deposition, and so allows the combined inputs of sulphur and nitrogen deposition to be considered. The function is a three-node line on a graph representing the acidity critical load, with combinations above this line exceeding the critical load. All areas below or on the line represent an "envelope of protection" where critical loads are not exceeded. An example graph is shown in Figure 6.1/1 below.

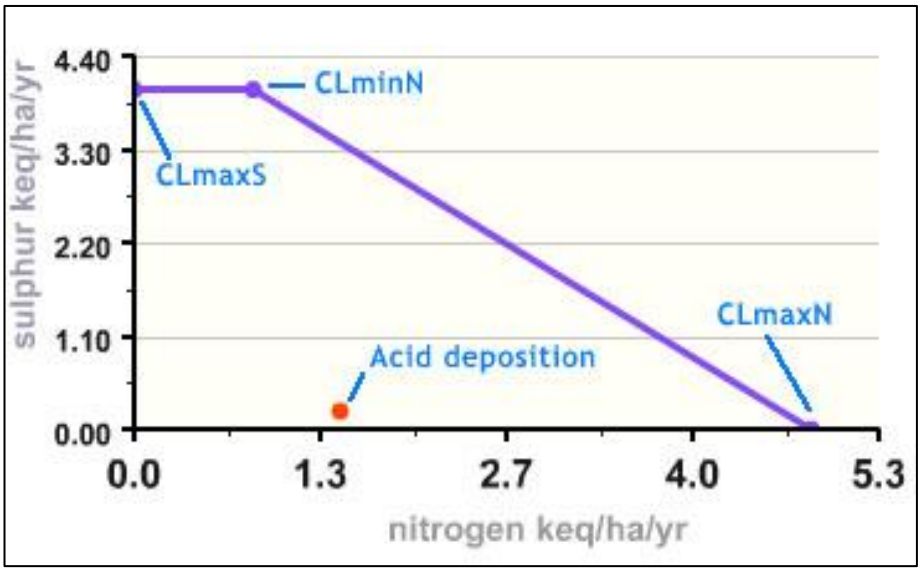


Figure 6.1/1: Example critical load function graph, reproduced from the APIS website

1.32 The guidance enables a calculation to be made of the contribution to acid deposition as a percentage of the relevant critical load value, and advises:

"Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.

Where PEC N Deposition > CLminN

*PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100"*.

APPENDIX 6.2: METHODOLOGY FOR CONSTRUCTION PHASE ASSESSMENT

Institute of Air Quality Management Guidance

1.1 The methodology for the construction phase dust assessment is set out in guidance from the Institute of Air Quality Management (IAQM)[1].

Step 1

1.2 Step 1 is to screen the requirement for a more detailed assessment. The guidance states that an assessment will normally be required where there are existing sensitive human receptors within 350m of the site boundary and/or within 100m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

1.3 With regards to ecological receptors, the guidance states that an assessment will normally be required where there are existing receptors within 50m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

1.4 Where any of these criteria are met, it is necessary to proceed to Step 2.

Step 2

1.5 Step 2 determines the potential risk of dust arising in sufficient quantities to cause annoyance and/or health or ecological impacts. The risk is related to:

- The activities being undertaken (demolition, number of vehicles and plant etc);
- The duration of these activities;
- The size of the site;
- The meteorological conditions (wind speed, direction and rainfall);
- The proximity of receptors to the activity;
- The adequacy of the mitigation measures applied to reduce or eliminate dust; and
- The sensitivity of receptors to dust.

1.6 The risk of dust impacts is determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based upon the following

[1] Institute of Air Quality Management, Guidance on the Assessment of Dust from Demolition and Construction v1.1, June 2016

two factors (known as Step 2A and Step 2B).

1.7 **Step 2A** assesses the scale and nature of the works which determines the potential dust emission magnitude as small, medium or large. Examples of how the magnitude may be defined are included in Table A6.2/1.

Table A6.2/1: Determining the Dust Emission Magnitude of Construction Phase Activities

Activity	Dust Emission Class		
	Large	**Medium**	**Small**
Demolition	Total building volume >50,000m^3; Potentially dusty construction material (e.g. concrete); On-site crushing and screening; Demolition activities >20m above ground level	Total building volume 20,000-50,000m^3; Potentially dusty construction material; Demolition activities 10-20m above ground level	Total building volume <20,000m^3; Construction material with low potential for dust release (e.g. metal cladding or timber)
Earthworks	Total site area >10,000m^2; Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); >10 heavy earth moving vehicles active at any one time; Formation of bunds >8m in height; Total material moved >100,000 tonnes	Total site area 2,500-10,000m^2; Moderately dusty soil type (e.g. silt); 5-10 heavy earth moving vehicles active at any one time; Formation of bunds 4-8m in height; Total material moved 20,000-100,000 tonnes	Total site area <2,500m^2; Soil type with large grain size (e.g. sand); <5 heavy earth moving vehicles active at any one time; Formation of bunds <4m in height; Total material moved <20,000 tonnes; Earthworks during wetter months
Construction	Total building volume >100,000m^3; On-site concrete batching; Sandblasting	Total building volume 25,000-100,000m^3; Potentially dusty construction material (e.g. concrete); On-site batching	Total building volume <25,000m^3; Construction material with a low potential for dust release (e.g. metal cladding or timber)
Trackout	>50 HDV (>3.5t) outward movements[a] in any one day[b]; Potentially dusty surface material (e.g. high clay content); Unpaved road length >100m	10-50 HDV (>3,5t) outward movements[a] in any one day[b]; Moderately dusty surface material (e.g. high clay content); Unpaved road length 50-100m	<10 HDV (>3.5t) outward movements[a] in any one day[b]; Surface material with low potential for dust release; Unpaved road length <50m

a. A vehicle movement is a one way journey i.e. from A to B, and excludes the return journey
b. HGV movements during a construction project may vary over its lifetime, and the number of movements is the maximum, not the average

1.8 **Step 2B** considers the sensitivity of the area to dust impacts which is defined as low, medium or high. The sensitivity categories for different types of receptors are described in Table A6.2/2.

Table A6.2/2: Sensitivity Categories for Dust Soiling, Human Health and Ecological Effects			
Sensitivity Category	**Dust Soiling Effects**	**Health effects of PM_{10}**	**Ecological Effects**
High	Users can reasonably expect to enjoy a high level of amenity; Appearance, aesthetics or value of a property would be diminished; Examples include dwellings, museums and other culturally important collections, medium and long term car parks and car show rooms	Locations where members of the public are exposed over a period of time relevant to the air quality objective for PM_{10}; Examples include residential properties, hospitals, schools, and residential care homes	Locations with an international or national designation and the designated features may be affected by dust soiling; Locations where there is a community of a particularly dust sensitive species; Examples include a Special Area of Conservation with dust sensitive features
Medium	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; The appearance, aesthetics or value of their property could be diminished; People or property wouldn't reasonably be expected to be continuously present or regularly for extended periods of time; Examples include parks and places of work	Locations where people are exposed as workers and exposure is over a period of time relevant to the air quality objective for PM_{10}; Examples include office and shop workers but will generally not include workers occupationally exposed to PM_{10}	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; Locations with a national designation where the features may be affected by dust deposition; Examples include a Site of Special Scientific Interest with dust sensitive features
Low	Enjoyment of amenity would not reasonably be expected; Property would not be diminished in appearance, aesthetics or value; People or property would be expected to be present only for limited periods of time; Examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads	Locations where human exposure is transient; Examples include public footpaths, playing fields, parks and shopping streets	Locations with a local designation where the features may be affected by dust deposition; Examples include a Local Nature Reserve with dust sensitive features

1.9 Based on the sensitivity of individual receptors, the overall sensitivity of the area to dust soiling, human health and ecological effects is then determined using the criteria detailed in Tables A6.2/3 to A6.2/5, respectively.

Table A6.2/3: Sensitivity of the Area to Dust Soiling Effects on People and Property[ab]					
Receptor Sensitivity	**Number of Receptors**	**Distance from Source (m)[c]**			
		<20m	**<50m**	**<100m**	**<350m**
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

a. The sensitivity to the area should be derived for each of the four activities

b. Estimate the total number of receptors within the stated distance. Only the highest level of sensitivity from the table needs to be considered

c. For trackout, distances should be measured from the side of the roads used by construction traffic. Without site specific mitigation, trackout may occur for up to 500m from large sites, 200m from medium sites and 50m from small sites, measured from the site exit. The impact declines with distance from the site and it is only necessary to consider trackout impacts up to 50m from the edge of the road

Table A6.2/4: Sensitivity of the Area to Human Health Impacts[ab]							
Receptor Sensitivity	**Annual Mean PM_{10} Concentration[c]**	**Number of Receptors[d]**	**Distance from Source (m)[e]**				
			<20m	**<50m**	**<100m**	**<200m**	**<350m**
High	>32µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

Table A6.2/4: Sensitivity of the Area to Human Health Impacts[ab]							
Receptor Sensitivity	**Annual Mean PM_{10} Concentration[c]**	**Number of Receptors[d]**	**Distance from Source (m)[e]**				
			<20m	**<50m**	**<100m**	**<200m**	**<350m**
Low	-	>1	Low	Low	Low	Low	Low
a. *The sensitivity to the area should be derived for each of the four activities*							
b. Estimate the total number of receptors within the stated distance. Only the highest level of sensitivity from the table needs to be considered							
c. Most straightforwardly taken from the national background maps, but should also take account of local sources. The values are based on 32µg/m³ being the annual mean concentration at which an exceedance of the 24-hour mean objective is likely in England, Wales and Northern Ireland. In Scotland, there is an annual mean objective of 18µg/m³							
d. In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties							
e. For trackout, distances should be measured from the side of the roads used by construction traffic							

Table A6.2/5: Sensitivity of the Area to Ecological Impacts[abc]		
Receptor Sensitivity	**Distance from the Source (m)**	
	<20	**<50**
High	High	Medium
Medium	Medium	Low
Low	Low	Low
a. *The sensitivity to the area should be derived for each of the four activities*		
b. Only the highest level of sensitivity from the table needs to be considered		
c. For trackout, distances should be measured from the side of the roads used by construction traffic		

1.10 These two factors are combined in **Step 2C** to determine the risk of dust impacts with no mitigation applied.

1.11 The risk of dust effects is determined for four types of construction phase activities, with each activity being considered separately. If a construction phase activity is not taking place on the site, then it does not need to be assessed. The four types of activities to be considered are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

1.12 The risk of dust being generated by demolition activities at the site is determined using the criteria in Table A6.2/6.

Table A6.2/6: Risk of Dust Impacts for Demolition			
Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

1.13 The risk of dust being generated by earthworks and construction at the site is determined using the criteria in Table A6.2/7.

Table A6.2/7: Risk of Dust Impacts for Earthworks and Construction			
Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

1.14 The risk of dust being generated by trackout at the site is determined using the criteria in Table A6.2/8.

Table A6.2/8: Risk of Dust Impacts for Trackout			
Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Medium Risk	Low Risk	Negligible

Step 3

1.15 Step 3 of the assessment determines the site-specific mitigation required for each of the activities, based on the risk determined in Step 2. Mitigation measures are detailed in guidance published by the Greater London Authority[2], recommended for use outside the capital by LAQM guidance, and the IAQM guidance document itself. Professional judgement should be used to determine the type and scale of mitigation measures required.

1.16 If the risk is classed as negligible, no mitigation measures beyond those required by legislation will be necessary.

[11] Greater London Authority, The Control of Dust and Emissions from Construction and Demolition: Best Practice Guidance, 2006

Step 4

1.17 Step 4 assesses the residual effect, with mitigation measures in place, to determine whether or not these are significant.

Professional Judgement

1.18 The IAQM guidance makes reference to the use of professional judgement when assessing the risks of dust and fine particulate matter from demolition and construction sites. Details of the experience of the personnel involved with the project are provided in **Appendix 6.6**.

APPENDIX 6.3: METHODOLOGY FOR OPERATIONAL PHASE ASSESSMENT

Atmospheric Dispersion Modelling

1.1 The atmospheric dispersion model AERMOD (Lakes Environmental, Version 11.2) has been used to assess the potential air quality impacts associated with the operation of the proposed battery manufacturing facility. This dispersion model is widely used and accepted for the purpose of undertaking assessments to support both planning and Environmental Permit applications.

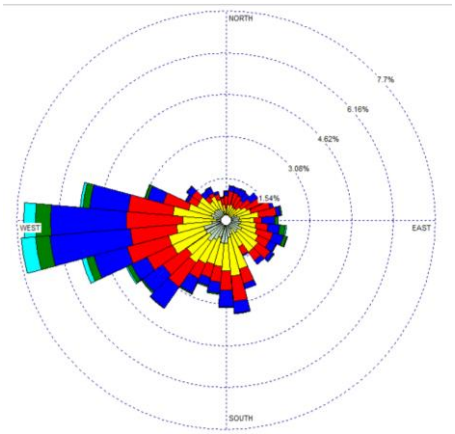
Meteorological Data

1.2 The meteorological data used in the air quality modelling has been obtained from ADM Limited and is from the Newcastle Airport recording station, covering the period between 1st January 2018 and 31st December 2022.

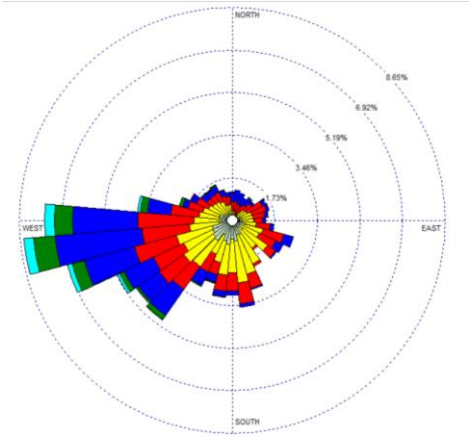
1.3 The site is located at an altitude of approximately 38m AOD. The Newcastle Airport recording station is located approximately 19km to the north west, at an altitude of approximately 81m AOD. This recording station is considered to be most representative of the conditions at the site.

1.4 The 2018 to 2022 wind roses for the Newcastle Airport meteorological recording station are shown in Figure 6.3/1. Each year has been run separately in the model.

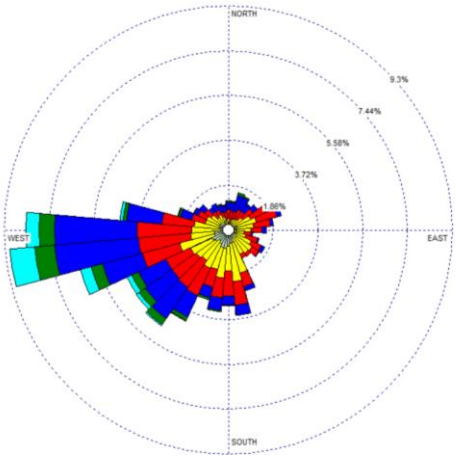
Figure 6.3/1: 2018 to 2022 Wind Roses for Newcastle Airport Meteorological Station



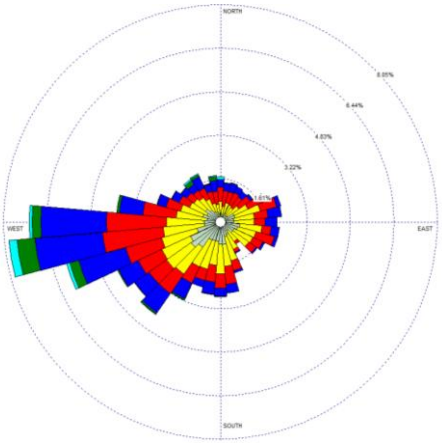
2018



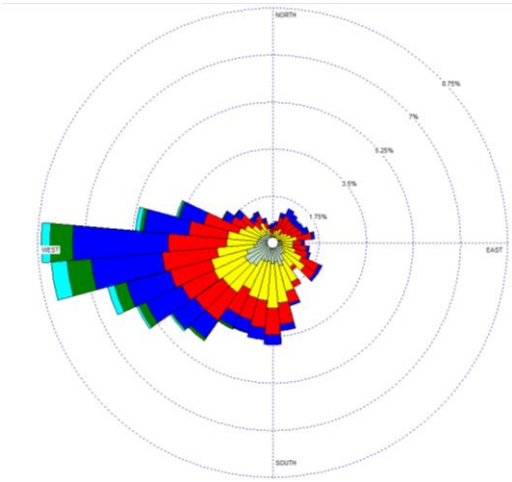
2019



2020



2021



2022

Surface Characteristics

1.5 The predominant characteristics of land use in an area provides a measure of the vertical mixing and dilution that takes place in the atmosphere due to factors such as surface roughness and albedo.

1.6 The meteorological data has been processed using AERMET, the supporting meteorological pre-processing software (Lakes Environmental, Version 11.2), to enable the surface characteristics to be set in the model.

1.7 The values set within the model are included in Table 6.3/1.

Table 6.3/1: Surface Characteristics Included in Model

Setting	Urban	Cultivated Land
Albedo	0.2075	0.28
Bowen ratio	1.625	0.75
Surface roughness	1m	0.0725m

1.8 Buildings can also have a significant influence on the behaviour of the local airflow and 'downwash' can occur, where an emission plume can be drawn down in the vicinity of buildings. There are a number of existing buildings near to the sources of the emissions, as well as the proposed buildings, and therefore building effects have been included within the model.

1.9 Further details of the buildings included in the model are provided later in this appendix.

Terrain

1.10 To consider the impact of terrain surrounding the Proposed Development, on the dispersion of pollutants, OS Terrain 5 data has been used in the model (in x.y.z format). This has been processed using the in-built AERMAP terrain processor.

Emission Parameters

1.11 A number of emission sources have been considered within the air dispersion model. These relate to different parts of the battery manufacturing process, and further information on the process is included in Chapter 6 of the Environmental Statement.

1.12 The forty-two sources considered within the assessment, and the pollutants considered for each source, are as follows:

- 6 No. stacks associated with the boilers.
- 21 No. stacks associated with N-Methyl-2-Pyrrolidone (NMP) emissions.
- 10 stacks associated with Ethyl Carbonate (EC) emissions.
- 5 stacks associated with Diethyl Carbonate Solvent Vapour (DEC) emissions.

1.13 Information regarding the flues for the sources has been provided by the client.

Table 6.3/2: Model Parameters for Sources Included in Model

Parameter	Input in Model															
	Boiler Stack (1 of 6)	**VOC 1-7**	**VOC 8-9**	**VOC 10**	**VOC 11**	**VOC 12-14**	**VOC 15**	**VOC 16-19**	**VOC 20-23**	**VOC 24-27**	**VOC 28**	**VOC 29**	**VOC 30**	**VOC 31**	**VOC 32**	**VOC 33-36**
Flue location	433167, 558781	433148, 558773	433165, 558780	433105, 558753	433105, 558753	433380, 558835	433327, 558721	433196, 558669	433198, 558664	433209, 558675	433116, 558655	433147, 558586	433148, 558586	433149, 558583	433162, 558555	433243, 558564
Base elevation	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD	38.70m AOD
Exhaust height[a]	36m	33m	33m	33m	33m	19m	19m	33m	33m	33m	33m	33m	33m	33m	33m	33m
Exhaust diameter	0.45m	0.45m	0.45m	0.30m	0.41m	0.40m	0.45m	0.46m	0.45m	0.46m	0.30m	0.29m	0.29m	0.37m	0.26m	0.46m
Exhaust gas flow at exit	6660 Am^3/hr (1.850 Am^3/s)	10080 Am^3/hr (2.800 Am^3/s)	10080 Am^3/hr (2.800 Am^3/s)	4564 Am^3/hr (1.268 Am^3/s)	7560 Am^3/hr (2.100 Am^3/s)	8460 Am^3/hr (2.350 Am^3/s)	10432 Am^3/hr (2.898 Am^3/s)	11376 Am^3/hr (3.160 Am^3/s)	10080 Am^3/hr (2.800 Am^3/s)	11376 Am^3/hr (3.160 Am^3/s)	4082 Am^3/hr (1.134 Am^3/s)	4082 Am^3/hr (1.134 Am^3/s)	4082 Am^3/hr (1.134 Am^3/s)	6624 Am^3/hr (1.840 Am^3/s)	3358 Am^3/hr (0.933 Am^3/s)	11376 Am^3/hr (3.160 Am^3/s)
Exhaust efflux velocity	12.00m/s	18.00 m/s	18.00 m/s	17.90 m/s	16.00 m/s	19.00 m/s	18.00 m/s	19.00 m/s	18.00 m/s	19.00 m/s	16.00 m/s	18.00 m/s	18.00 m/s	17.00 m/s	18.00 m/s	19.00 m/s
Exhaust gas exit temp.	128°C	25°C	20°C	20°C	20°C	20°C	20°C	25°C	25°C	20°C	20°C	20°C	20°C	25°C	25°C	25°C

1.14 The locations of the stacks included within the model are shown in Figure 6.3/2.

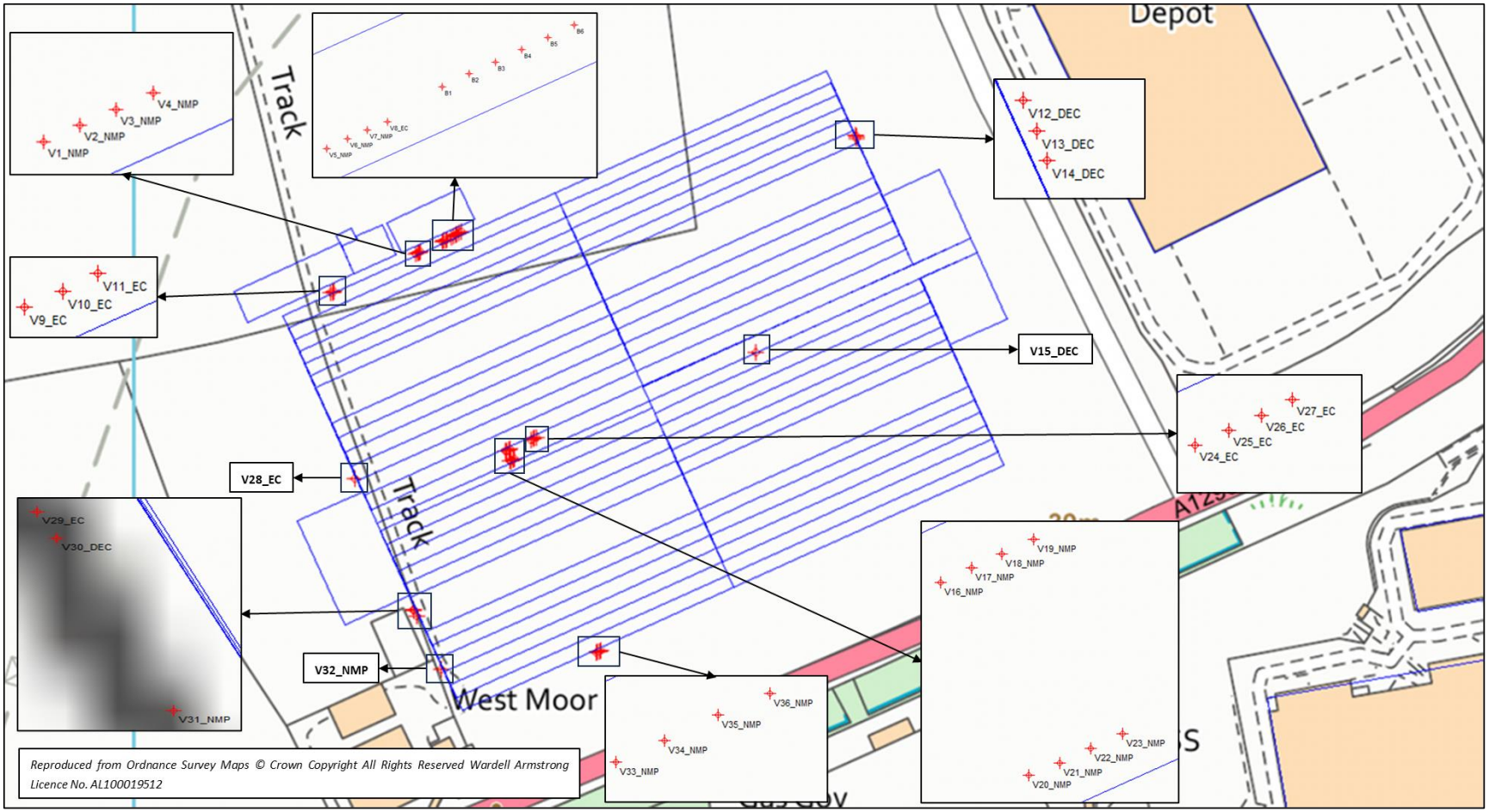


Figure 6.3/2: Location of Emission Sources in Model

1.15 The maximum emission concentrations for each substance, as provided by Envision, as well as the calculated emission rates are shown in Table 6.3/3 below.

Table 6.3/3: Emission Rates for Sources Included in Model															
Emitted Substance	**Input in Model**														
	Boiler Stack (1 of 6)	**VOC 1-7**	**VOC 8-9**	**VOC 10**	**VOC 11**	**VOC 12-14**	**VOC 15**	**VOC 16-19**	**VOC 20-23**	**VOC 24-27**	**VOC 28**	**VOC 29**	**VOC 30**	**VOC 31**	**VOC 32**
	Emission Concentration (mg/Nm³)														
NO_X	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NMP		2	-	-	-	-	-	2	2	-	-	-	-	2	2
Ethyl Carbonate	-	-	15	15	15	-	-	-	-	15	15	15	-	-	-
DiEthyl Carbonate	-	-	-	-	-	20	20	-	-	-	-	-	20	-	-
	Emission Rate (g/s)														
NO_X	0.1067	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO	0.0213	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NMP	-	0.0051	-	-	-	-	-	0.0058	0.0051	-	-	-	-	0.0034	0.0017
Ethyl Carbonate	-	-	0.0385	0.0177	0.0293	-	-	-	-	0.0434	0.0158	0.0158	-	-	-
DiEthyl Carbonate	-	-	-	-	-	0.0438	0.0540	-	-	-	-	-	0.0211	-	-

Treatment of Buildings

1.16 The proposed building for the battery manufacturing processes has been included within the model. The building has been split into different sections, to represent the different heights of each part of the building.

1.17 There are also a number of existing buildings located in the neighbouring industrial area to the south, and the buildings within Phase 1 of IAMP to the north east.

1.18 The buildings included within the model are detailed in Table 6.3/4.

Table 6.3/4: Onsite Buildings Included in Model

Building Number	Building Name in Model	Building Description	Base Elevation (m)	Height of Building (m)	Grid Reference of SW Corner	
					X	Y
1[a]	BLD_1	On-site Building 1	38.70	30.00	433078.96	558740.09
2[a]	BLD_2	On-site Building 2	38.70	30.00	433172.70	558533.07
3[a]	BLD_3	On-site Building 3	38.70	16.00	433267.77	558703.55
4[a]	BLD_4	On-site Building 4	38.70	16.00	433315.63	558597.67
5	BLD_5	On-site Building 5	38.70	11.20	433271.10	558695.81
6	BLD_6	On-site Building 6	38.70	16.00	433111.43	558578.35
7	BLD_8	On-site Building 8	38.70	16.00	433429.07	558725.26
8	BLD_9	On-site Building 9	38.70	16.00	433451.44	558705.23
9	BLD_14	Off-site Building 1	38.79	12.00	433026.14	558095.42
10	BLD_15	Off-site Building 2	40.50	12.00	433262.55	558264.52
11	BLD_16	Off-site Building 3	35.18	15.00	433725.71	558146.97
12	BLD_17	Off-site Building 4	36.54	25.00	433674.63	558585.11
13	BLD_18	Off-site Building 5	35.96	19.00	433536.75	558773.64
14	BLD_19	Off-site Building 6	35.67	15.00	433659.35	559063.87
15	BLD_20	Off-site Building 7	36.05	15.00	433714.85	559264.98
16	BLD_21	On-site building 10	38.70	11	433052.94	558753.20
17	BLD_22	On-site building 11	38.70	17	433109.49	558776.92
18	BLD_23	On-site building 12	38.70	22	433106.86	558782.50
19	BLD_24	On-site building 12	38.70	14	433133.53	558789.49

[a] Modelled as tiered buildings to take into account the curvature of the roof. The ridge has been set to 30m above base elevation and the eaves at 28m above base elevation

1.19 The locations of the on-Site buildings are shown in Figure 6.3/3, and the off-Site buildings are shown in Figure 6.3/4 below.

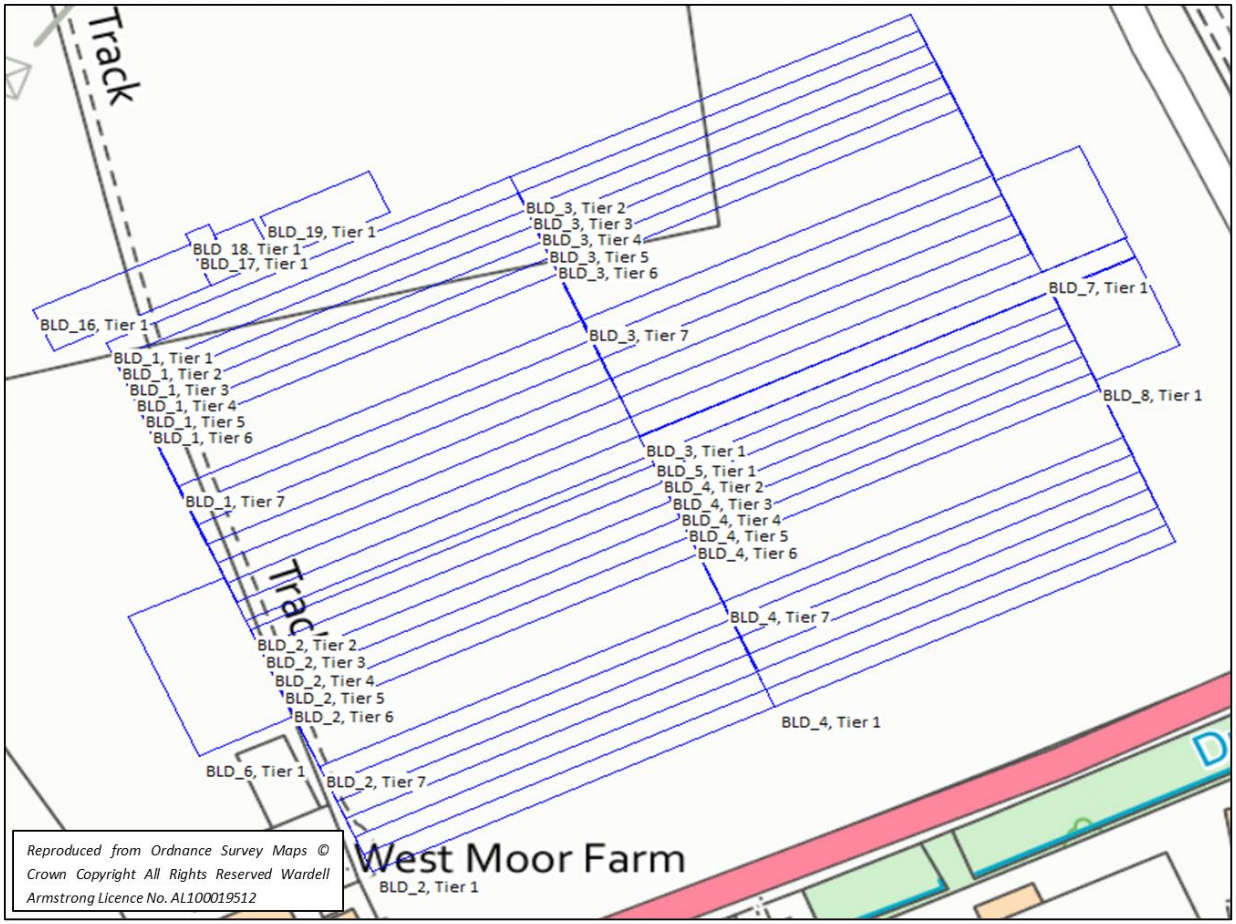


Figure 6.3/3: Location of On-site Buildings in Model

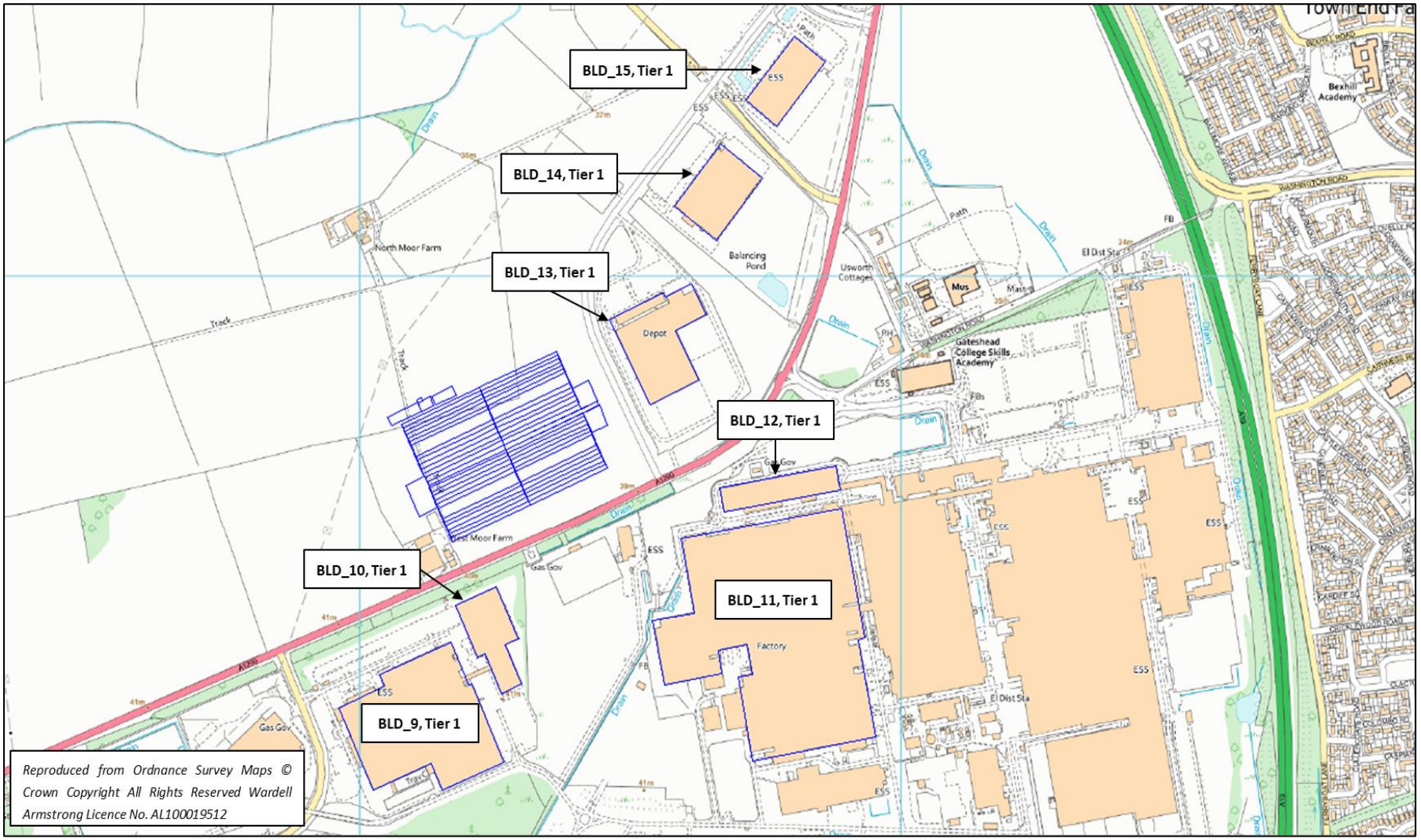


Figure 6.3/4: Location of Off-site Buildings in Model

APPENDIX 6.4: OPERATIONAL PHASE ASSESSMENT RESULTS

Predicted NO_2, CO, NMP and Ethyl Carbonate Concentrations for Existing Sensitive Human Receptors

Predicted NO_2 Concentrations

1.1 The predicted NO_2 concentrations for the existing sensitive receptors and points across the receptor grid, for each year of meteorological data, are shown in Figures 6.4/1 to 6.4/5, below. The highest results for the receptors considered are highlighted in red.

Figure 6.4/1: 2018 Meteorological Data

				SHORT TERM 99.79th PERCENTILE					LONG TERM				
				PC 99.79th %ile	PC	PEC	PC/AQO	PEC/AQO	PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		NO_x 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_x ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL
		X	Y	µg/m^3	µg/m^3	µg/m^3	%	%	µg/m^3	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	25.44	12.72	34.43	6.36	17.21	0.58	0.58	11.43	1.45	28.59
ESR 2	Property along Downhill Lane	433325.17	559682.26	23.10	11.55	33.26	5.77	16.63	0.49	0.49	11.35	1.24	28.37
ESR 3	Property off Washington Road	433964.30	559014.14	19.33	9.67	31.37	4.83	15.69	0.61	0.61	11.46	1.53	28.66
ESR 4	Property along Boston Crescent	434421.17	559599.51	11.45	5.72	34.40	2.86	17.20	0.24	0.24	14.58	0.60	36.45
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	11.58	5.79	34.46	2.89	17.23	0.30	0.30	14.64	0.76	36.60
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	9.97	4.99	49.64	2.49	24.82	0.27	0.27	22.59	0.67	56.49
ESR 7	Property at Seven Houses	432334.01	557786.97	10.08	5.04	31.12	2.52	15.56	0.09	0.09	13.13	0.23	32.82
ESR 8	Property along Sulgrave Road	431863.91	558150.44	9.69	4.85	30.78	2.42	15.39	0.10	0.10	13.07	0.25	32.67
ESR 9	Property along Watcombe Close	431633.25	558996.97	9.10	4.55	30.49	2.28	15.24	0.08	0.08	13.05	0.20	32.62
ESR 10	East House Farm	431811.19	559417.59	11.32	5.66	26.88	2.83	13.44	0.12	0.12	10.73	0.29	26.82
ESR 11	Property along Follingsby Lane	432337.30	559964.76	13.53	6.77	27.02	3.38	13.51	0.15	0.15	10.28	0.38	25.70

Figure 6.4/2: 2019 Meteorological Data

				SHORT TERM 99.79th PERCENTILE					LONG TERM				
				PC 99.79th %ile	PC	PEC	PC/AQO	PEC/AQO	PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		NO_x 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_x ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL
		X	Y	µg/m³	µg/m³	µg/m³	%	%	µg/m³	µg/m³	µg/m³	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	29.61	14.81	36.51	7.40	18.26	0.68	0.68	11.53	1.70	28.83
ESR 2	Property along Downhill Lane	433325.17	559682.26	28.16	14.08	35.79	7.04	17.89	0.57	0.57	11.43	1.43	28.57
ESR 3	Property off Washington Road	433964.30	559014.14	20.21	10.11	31.81	5.05	15.91	0.66	0.66	11.51	1.64	28.77
ESR 4	Property along Boston Crescent	434421.17	559599.51	13.33	6.66	35.34	3.33	17.67	0.31	0.31	14.64	0.77	36.61
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	12.58	6.29	34.96	3.14	17.48	0.33	0.33	14.66	0.82	36.66
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	9.99	4.99	49.65	2.50	24.83	0.27	0.27	22.59	0.66	56.48
ESR 7	Property at Seven Houses	432334.01	557786.97	7.92	3.96	30.04	1.98	15.02	0.08	0.08	13.12	0.19	32.79
ESR 8	Property along Sulgrave Road	431863.91	558150.44	7.35	3.68	29.61	1.84	14.81	0.07	0.07	13.04	0.18	32.60
ESR 9	Property along Watcombe Close	431633.25	558996.97	4.82	2.41	28.35	1.20	14.17	0.06	0.06	13.03	0.16	32.58
ESR 10	East House Farm	431811.19	559417.59	7.77	3.88	25.11	1.94	12.55	0.09	0.09	10.70	0.23	26.76
ESR 11	Property along Follingsby Lane	432337.30	559964.76	13.48	6.74	26.99	3.37	13.50	0.16	0.16	10.28	0.39	25.71

Figure 6.4/3: 2020 Meteorological Data

				SHORT TERM 99.79th PERCENTILE					LONG TERM				
				PC 99.79th %ile	PC	PEC	PC/AQO	PEC/AQO	PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		NO_x 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_x ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL
		X	Y	µg/m³	µg/m³	µg/m³	%	%	µg/m³	µg/m³	µg/m³	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	28.00	14.00	35.71	7.00	17.85	0.62	0.62	11.48	1.56	28.69
ESR 2	Property along Downhill Lane	433325.17	559682.26	24.66	12.33	34.04	6.16	17.02	0.52	0.52	11.37	1.30	28.43
ESR 3	Property off Washington Road	433964.30	559014.14	18.35	9.17	30.88	4.59	15.44	0.64	0.64	11.49	1.60	28.74
ESR 4	Property along Boston Crescent	434421.17	559599.51	11.68	5.84	34.51	2.92	17.26	0.25	0.25	14.58	0.61	36.46
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	10.94	5.47	34.15	2.74	17.07	0.33	0.33	14.66	0.82	36.66
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	8.91	4.46	49.11	2.23	24.56	0.28	0.28	22.60	0.69	56.51
ESR 7	Property at Seven Houses	432334.01	557786.97	9.90	4.95	31.03	2.47	15.51	0.09	0.09	13.13	0.23	32.83
ESR 8	Property along Sulgrave Road	431863.91	558150.44	9.26	4.63	30.57	2.32	15.28	0.10	0.10	13.06	0.24	32.66
ESR 9	Property along Watcombe Close	431633.25	558996.97	5.13	2.57	28.50	1.28	14.25	0.05	0.05	13.02	0.13	32.55
ESR 10	East House Farm	431811.19	559417.59	7.55	3.77	25.00	1.89	12.50	0.07	0.07	10.68	0.16	26.69
ESR 11	Property along Follingsby Lane	432337.30	559964.76	10.43	5.21	25.47	2.61	12.73	0.12	0.12	10.25	0.30	25.61

Figure 6.4/4: 2021 Meteorological Data

				SHORT TERM 99.79th PERCENTILE					LONG TERM				
				PC 99.79th %ile	PC	PEC	PC/AQO	PEC/AQO	PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		NO_x 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_x ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL
		X	Y	µg/m³	µg/m³	µg/m³	%	%	µg/m³	µg/m³	µg/m³	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	27.52	13.76	35.47	6.88	17.73	0.58	0.58	11.44	1.46	28.59
ESR 2	Property along Downhill Lane	433325.17	559682.26	23.18	11.59	33.30	5.79	16.65	0.48	0.48	11.33	1.19	28.33
ESR 3	Property off Washington Road	433964.30	559014.14	20.36	10.18	31.89	5.09	15.94	0.65	0.65	11.51	1.64	28.77
ESR 4	Property along Boston Crescent	434421.17	559599.51	13.79	6.90	35.57	3.45	17.79	0.31	0.31	14.64	0.77	36.61
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	13.33	6.67	35.34	3.33	17.67	0.33	0.33	14.67	0.83	36.67
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	10.70	5.35	50.01	2.68	25.00	0.29	0.29	22.62	0.73	56.55
ESR 7	Property at Seven Houses	432334.01	557786.97	12.59	6.30	32.38	3.15	16.19	0.12	0.12	13.16	0.30	32.89
ESR 8	Property along Sulgrave Road	431863.91	558150.44	10.66	5.33	31.26	2.66	15.63	0.11	0.11	13.08	0.27	32.69
ESR 9	Property along Watcombe Close	431633.25	558996.97	8.86	4.43	30.37	2.22	15.18	0.09	0.09	13.06	0.23	32.65
ESR 10	East House Farm	431811.19	559417.59	11.34	5.67	26.89	2.83	13.45	0.10	0.10	10.72	0.26	26.79
ESR 11	Property along Follingsby Lane	432337.30	559964.76	9.33	4.67	24.92	2.33	12.46	0.10	0.10	10.23	0.25	25.57

Figure 6.4/5: 2022 Meteorological Data

				SHORT TERM 99.79th PERCENTILE					LONG TERM				
				PC 99.79th %ile	PC	PEC	PC/AQO	PEC/AQO	PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		NO_x 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_2 1 HOUR	NO_x ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL	NO_2 ANNUAL
		X	Y	µg/m³	µg/m³	µg/m³	%	%	µg/m³	µg/m³	µg/m³	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	25.17	12.58	34.29	6.29	17.15	0.62	0.62	11.47	1.54	28.67
ESR 2	Property along Downhill Lane	433325.17	559682.26	23.06	11.53	33.24	5.77	16.62	0.51	0.51	11.37	1.28	28.42
ESR 3	Property off Washington Road	433964.30	559014.14	19.87	9.93	31.64	4.97	15.82	0.67	0.67	11.52	1.67	28.81
ESR 4	Property along Boston Crescent	434421.17	559599.51	11.80	5.90	34.57	2.95	17.29	0.29	0.29	14.62	0.72	36.56
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	12.83	6.41	35.09	3.21	17.54	0.34	0.34	14.67	0.84	36.68
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	10.91	5.45	50.11	2.73	25.05	0.29	0.29	22.62	0.74	56.56
ESR 7	Property at Seven Houses	432334.01	557786.97	7.71	3.85	29.93	1.93	14.97	0.09	0.09	13.12	0.21	32.81
ESR 8	Property along Sulgrave Road	431863.91	558150.44	8.22	4.11	30.05	2.06	15.02	0.07	0.07	13.04	0.19	32.61
ESR 9	Property along Watcombe Close	431633.25	558996.97	4.51	2.25	28.19	1.13	14.10	0.05	0.05	13.02	0.12	32.54
ESR 10	East House Farm	431811.19	559417.59	6.57	3.28	24.51	1.64	12.25	0.07	0.07	10.68	0.17	26.70
ESR 11	Property along Follingsby Lane	432337.30	559964.76	10.51	5.25	25.51	2.63	12.75	0.13	0.13	10.25	0.32	25.64

Predicted CO Concentrations

1.2 The predicted CO concentrations for the existing sensitive receptors and points across the receptor grid, for each year of meteorological data, are shown in Figures 6.4/6 to 6.4/10, below. The highest results for the receptors considered are highlighted in red.

Figure 6.4/6: 2018 Meteorological Data

				SHORT TERM				
				PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		8 HOUR	8 HOUR	8 HOUR	8 HOUR	8 HOUR
		X	Y	µg/m³	mg/m³	mg/m³	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	2.93	0.0029	0.19	0.03	1.89
ESR 2	Property along Downhill Lane	433325.17	559682.26	2.91	0.0029	0.19	0.03	1.89
ESR 3	Property off Washington Road	433964.30	559014.14	1.24	0.0012	0.19	0.01	1.87
ESR 4	Property along Boston Crescent	434421.17	559599.51	1.10	0.0011	0.18	0.01	1.83
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.75	0.0007	0.18	0.01	1.83
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	1.35	0.0014	0.19	0.01	1.85
ESR 7	Property at Seven Houses	432334.01	557786.97	1.12	0.0011	0.19	0.01	1.90
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.93	0.0009	0.19	0.01	1.87
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.74	0.0007	0.19	0.01	1.87
ESR 10	East House Farm	431811.19	559417.59	0.97	0.0010	0.18	0.01	1.85
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.86	0.0009	0.19	0.01	1.86

Figure 6.4/7: 2019 Meteorological Data

				SHORT TERM				
				PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		8 HOUR	8 HOUR	8 HOUR	8 HOUR	8 HOUR
		X	Y	µg/m^3	mg/m^3	mg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	2.53	0.0025	0.19	0.03	1.88
ESR 2	Property along Downhill Lane	433325.17	559682.26	2.63	0.0026	0.19	0.03	1.88
ESR 3	Property off Washington Road	433964.30	559014.14	2.43	0.0024	0.19	0.02	1.88
ESR 4	Property along Boston Crescent	434421.17	559599.51	1.26	0.0013	0.18	0.01	1.83
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	1.45	0.0014	0.18	0.01	1.84
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	1.08	0.0011	0.19	0.01	1.85
ESR 7	Property at Seven Houses	432334.01	557786.97	0.79	0.0008	0.19	0.01	1.89
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.56	0.0006	0.19	0.01	1.86
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.60	0.0006	0.19	0.01	1.86
ESR 10	East House Farm	431811.19	559417.59	0.54	0.0005	0.18	0.01	1.85
ESR 11	Property along Follingsby Lane	432337.30	559964.76	1.44	0.0014	0.19	0.01	1.86

Figure 6.4/8: 2020 Meteorological Data

				SHORT TERM				
				PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		8 HOUR	8 HOUR	8 HOUR	8 HOUR	8 HOUR
		X	Y	µg/m^3	mg/m^3	mg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	3.15	0.0031	0.1890	0.0315	1.8896
ESR 2	Property along Downhill Lane	433325.17	559682.26	2.29	0.0023	0.1881	0.0229	1.8810
ESR 3	Property off Washington Road	433964.30	559014.14	1.78	0.0018	0.1876	0.0178	1.8759
ESR 4	Property along Boston Crescent	434421.17	559599.51	1.17	0.0012	0.1834	0.0117	1.8337
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.93	0.0009	0.1831	0.0093	1.8313
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.76	0.0008	0.1848	0.0076	1.8477
ESR 7	Property at Seven Houses	432334.01	557786.97	1.36	0.0014	0.1899	0.0136	1.8988
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.76	0.0008	0.1866	0.0076	1.8657
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.59	0.0006	0.1864	0.0059	1.8641
ESR 10	East House Farm	431811.19	559417.59	0.69	0.0007	0.1847	0.0069	1.8470
ESR 11	Property along Follingsby Lane	432337.30	559964.76	1.04	0.0010	0.1859	0.0104	1.8595

Figure 6.4/9: 2021 Meteorological Data

				SHORT TERM				
				PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		8 HOUR	8 HOUR	8 HOUR	8 HOUR	8 HOUR
		X	Y	µg/m^3	mg/m^3	mg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	2.73	0.0027	0.1885	0.0273	1.8854
ESR 2	Property along Downhill Lane	433325.17	559682.26	2.17	0.0022	0.1880	0.0217	1.8798
ESR 3	Property off Washington Road	433964.30	559014.14	2.11	0.0021	0.1879	0.0211	1.8792
ESR 4	Property along Boston Crescent	434421.17	559599.51	1.43	0.0014	0.1836	0.0143	1.8364
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	1.11	0.0011	0.1833	0.0111	1.8331
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.79	0.0008	0.1848	0.0079	1.8480
ESR 7	Property at Seven Houses	432334.01	557786.97	1.45	0.0015	**0.1900**	0.0145	**1.8997**
ESR 8	Property along Sulgrave Road	431863.91	558150.44	1.00	0.0010	0.1868	0.0100	1.8681
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.83	0.0008	0.1866	0.0083	1.8665
ESR 10	East House Farm	431811.19	559417.59	1.22	0.0012	0.1852	0.0122	1.8522
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.70	0.0007	0.1856	0.0070	1.8561

Figure 6.4/10: 2022 Meteorological Data

				SHORT TERM				
				PC	PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		8 HOUR	8 HOUR	8 HOUR	8 HOUR	8 HOUR
		X	Y	µg/m^3	mg/m^3	mg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	1.63	0.0016	0.1874	0.0163	1.8744
ESR 2	Property along Downhill Lane	433325.17	559682.26	1.38	0.0014	0.1872	0.0138	1.8720
ESR 3	Property off Washington Road	433964.30	559014.14	2.09	0.0021	0.1879	0.0209	1.8790
ESR 4	Property along Boston Crescent	434421.17	559599.51	1.25	0.0012	0.1835	0.0125	1.8345
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	1.12	0.0011	0.1833	0.0112	1.8332
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.80	0.0008	0.1848	0.0080	1.8481
ESR 7	Property at Seven Houses	432334.01	557786.97	0.75	0.0008	0.1893	0.0075	1.8927
ESR 8	Property along Sulgrave Road	431863.91	558150.44	1.19	0.0012	0.1870	0.0119	1.8700
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.73	0.0007	0.1865	0.0073	1.8654
ESR 10	East House Farm	431811.19	559417.59	1.06	0.0011	0.1851	0.0106	1.8507
ESR 11	Property along Follingsby Lane	432337.30	559964.76	1.02	0.0010	0.1859	0.0102	1.8593

Predicted NMP Concentrations

1.3 The predicted NMP concentrations for the existing sensitive receptors and points across the receptor grid, for each year of meteorological data, are shown in Figures 6.4/11 to 6.4/15, below. The highest results for the receptors considered are highlighted in red.

Figure 6.4/11: 2018 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.1026	0.58	2.05	11.56
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.0879	0.56	1.76	11.27
ESR 3	Property off Washington Road	433964.30	559014.14	0.1095	0.58	2.19	11.70
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.0501	0.48	1.00	9.61
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.0607	0.49	1.21	9.82
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.0577	0.49	1.15	9.77
ESR 7	Property at Seven Houses	432334.01	557786.97	0.0186	0.46	0.37	9.24
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.0227	0.50	0.45	9.98
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.0172	0.49	0.34	9.87
ESR 10	East House Farm	431811.19	559417.59	0.0241	0.49	0.48	9.86
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.0280	0.50	0.56	9.99

Figure 6.4/12: 2019 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.1229	0.60	2.46	11.97
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.1034	0.58	2.07	11.58
ESR 3	Property off Washington Road	433964.30	559014.14	0.1211	0.60	2.42	11.93
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.0623	0.49	1.25	9.85
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.0651	0.50	1.30	9.91
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.0568	0.49	1.14	9.76
ESR 7	Property at Seven Houses	432334.01	557786.97	0.0154	0.46	0.31	9.18
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.0156	0.49	0.31	9.83
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.0145	0.49	0.29	9.81
ESR 10	East House Farm	431811.19	559417.59	0.0185	0.49	0.37	9.75
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.0293	0.50	0.59	10.02

Figure 6.4/13: 2020 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.1086	0.58	2.17	11.68
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.0905	0.57	1.81	11.32
ESR 3	Property off Washington Road	433964.30	559014.14	0.1112	0.59	2.22	11.73
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.0493	0.48	0.99	9.59
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.0631	0.49	1.26	9.87
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.0591	0.49	1.18	9.80
ESR 7	Property at Seven Houses	432334.01	557786.97	0.0203	0.46	0.41	9.28
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.0200	0.50	0.40	9.92
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.0099	0.49	0.20	9.72
ESR 10	East House Farm	431811.19	559417.59	0.0141	0.48	0.28	9.66
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.0220	0.49	0.44	9.87

Figure 6.4/14: 2021 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.1040	0.58	2.08	11.59
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.0862	0.56	1.72	11.23
ESR 3	Property off Washington Road	433964.30	559014.14	0.1210	0.60	2.42	11.93
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.0635	0.49	1.27	9.88
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.0662	0.50	1.32	9.93
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.0635	0.49	1.27	9.89
ESR 7	Property at Seven Houses	432334.01	557786.97	0.0251	0.47	0.50	9.37
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.0238	0.50	0.48	10.00
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.0197	0.50	0.39	9.92
ESR 10	East House Farm	431811.19	559417.59	0.0205	0.49	0.41	9.78
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.0194	0.49	0.39	9.82

Figure 6.4/15: 2022 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.1048	0.58	2.10	11.60
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.0883	0.56	1.77	11.27
ESR 3	Property off Washington Road	433964.30	559014.14	0.1210	0.60	2.42	11.93
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.0605	0.49	1.21	9.82
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.0662	0.50	1.32	9.93
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.0613	0.49	1.23	9.84
ESR 7	Property at Seven Houses	432334.01	557786.97	0.0164	0.46	0.33	9.20
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.0156	0.49	0.31	9.83
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.0101	0.49	0.20	9.72
ESR 10	East House Farm	431811.19	559417.59	0.0138	0.48	0.28	9.65
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.0252	0.50	0.50	9.93

Predicted Ethyl Carbonate Concentrations

1.4 The predicted Ethyl Carbonate concentrations for the existing sensitive receptors and points across the receptor grid, for each year of meteorological data, are shown in Figures 6.4/16 to 6.4/20, below. The highest results for the receptors considered are highlighted in red.

Figure 6.4/16: 2018 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m³	µg/m³	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.26	0.73	5.17	14.67
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.22	0.70	4.43	13.94
ESR 3	Property off Washington Road	433964.30	559014.14	0.26	0.74	5.25	14.76
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.13	0.56	2.55	11.16
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.15	0.58	2.96	11.57
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.14	0.57	2.87	11.49
ESR 7	Property at Seven Houses	432334.01	557786.97	0.04	0.49	0.89	9.76
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.06	0.53	1.12	10.64
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.04	0.52	0.84	10.37
ESR 10	East House Farm	431811.19	559417.59	0.06	0.53	1.28	10.66
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.07	0.54	1.46	10.88

Figure 6.4/17: 2019 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.31	0.78	6.10	15.61
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.26	0.74	5.24	14.74
ESR 3	Property off Washington Road	433964.30	559014.14	0.28	0.76	5.68	15.19
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.16	0.59	3.19	11.80
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.16	0.59	3.18	11.79
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.14	0.57	2.86	11.48
ESR 7	Property at Seven Houses	432334.01	557786.97	0.04	0.48	0.74	9.61
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.04	0.51	0.77	10.30
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.03	0.51	0.69	10.21
ESR 10	East House Farm	431811.19	559417.59	0.05	0.52	0.97	10.34
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.08	0.55	1.54	10.97

Figure 6.4/18: 2020 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.27	0.75	5.49	15.00
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.23	0.71	4.62	14.13
ESR 3	Property off Washington Road	433964.30	559014.14	0.27	0.74	5.38	14.89
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.13	0.56	2.50	11.11
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.16	0.59	3.10	11.71
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.15	0.58	2.95	11.57
ESR 7	Property at Seven Houses	432334.01	557786.97	0.05	0.49	0.98	9.85
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.05	0.53	1.01	10.53
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.03	0.50	0.51	10.03
ESR 10	East House Farm	431811.19	559417.59	0.04	0.51	0.73	10.10
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.06	0.53	1.15	10.57

Figure 6.4/19: 2021 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.26	0.74	5.24	14.75
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.22	0.69	4.39	13.90
ESR 3	Property off Washington Road	433964.30	559014.14	0.28	0.76	5.67	15.18
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.16	0.59	3.27	11.88
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.16	0.59	3.24	11.84
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.16	0.59	3.21	11.83
ESR 7	Property at Seven Houses	432334.01	557786.97	0.06	0.50	1.21	10.08
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.06	0.54	1.19	10.72
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.05	0.52	0.97	10.49
ESR 10	East House Farm	431811.19	559417.59	0.05	0.52	1.05	10.43
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.05	0.52	1.02	10.45

Figure 6.4/20: 2020 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.27	0.74	5.32	14.82
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.23	0.70	4.54	14.05
ESR 3	Property off Washington Road	433964.30	559014.14	0.29	0.76	5.72	15.23
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.15	0.58	3.06	11.66
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.16	0.59	3.22	11.82
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.16	0.59	3.13	11.75
ESR 7	Property at Seven Houses	432334.01	557786.97	0.04	0.48	0.83	9.70
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.04	0.52	0.79	10.31
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.02	0.50	0.49	10.01
ESR 10	East House Farm	431811.19	559417.59	0.04	0.50	0.72	10.09
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.07	0.54	1.33	10.76

Predicted DiEthyl Carbonate Concentrations

1.5 The predicted Ethyl Carbonate concentrations for the existing sensitive receptors and points across the receptor grid, for each year of meteorological data, are shown in Figures 6.4/21 to 6.4/25, below. The highest results for the receptors considered are highlighted in red.

Figure 6.4/21: 2018 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.27	0.75	5.40	14.91
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.20	0.67	3.98	13.49
ESR 3	Property off Washington Road	433964.30	559014.14	0.36	0.83	7.12	16.63
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.13	0.56	2.62	11.22
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.16	0.59	3.19	11.80
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.15	0.58	2.95	11.57
ESR 7	Property at Seven Houses	432334.01	557786.97	0.04	0.48	0.73	9.60
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.04	0.52	0.83	10.35
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.04	0.52	0.83	10.35
ESR 10	East House Farm	431811.19	559417.59	0.05	0.52	1.08	10.46
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.07	0.54	1.37	10.80

Figure 6.4/22: 2019 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.30	0.77	5.94	15.44
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.22	0.69	4.37	13.88
ESR 3	Property off Washington Road	433964.30	559014.14	**0.40**	**0.87**	**7.94**	**17.45**
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.18	0.61	3.54	12.14
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.17	0.60	3.38	11.98
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.15	0.58	2.91	11.53
ESR 7	Property at Seven Houses	432334.01	557786.97	0.03	0.48	0.66	9.54
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.03	0.51	0.65	10.17
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.03	0.51	0.68	10.21
ESR 10	East House Farm	431811.19	559417.59	0.05	0.52	0.94	10.32
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.06	0.53	1.26	10.69

Figure 6.4/23: 2020 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.26	0.73	5.14	14.65
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.19	0.66	3.78	13.29
ESR 3	Property off Washington Road	433964.30	559014.14	0.38	0.86	7.67	17.18
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.13	0.56	2.67	11.28
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.17	0.60	3.40	12.00
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.15	0.58	3.05	11.67
ESR 7	Property at Seven Houses	432334.01	557786.97	0.04	0.49	0.86	9.73
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.04	0.52	0.86	10.38
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.03	0.50	0.56	10.09
ESR 10	East House Farm	431811.19	559417.59	0.03	0.50	0.63	10.01
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.05	0.53	1.08	10.51

Figure 6.4/24: 2021 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.25	0.72	4.95	14.45
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.19	0.66	3.71	13.22
ESR 3	Property off Washington Road	433964.30	559014.14	0.39	0.86	7.76	17.27
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.17	0.60	3.33	11.93
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.18	0.61	3.52	12.13
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.17	0.60	3.31	11.93
ESR 7	Property at Seven Houses	432334.01	557786.97	0.04	0.49	0.88	9.75
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.05	0.52	0.91	10.43
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.05	0.52	0.94	10.47
ESR 10	East House Farm	431811.19	559417.59	0.05	0.52	1.07	10.45
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.05	0.52	1.04	10.47

Figure 6.4/25: 2022 Meteorological Data

				LONG TERM ANNUAL MEAN			
				PC	PEC	PC/AQO	PEC/AQO
RECEPTOR	ADDRESS	GRID REFERENCE		ANNUAL	ANNUAL	ANNUAL	ANNUAL
		X	Y	µg/m^3	µg/m^3	%	%
ESR 1	Hylton Bridge Farm	433347.47	559511.37	0.27	0.75	5.47	14.97
ESR 2	Property along Downhill Lane	433325.17	559682.26	0.20	0.68	4.01	13.52
ESR 3	Property off Washington Road	433964.30	559014.14	0.39	0.87	7.82	17.33
ESR 4	Property along Boston Crescent	434421.17	559599.51	0.16	0.59	3.23	11.84
ESR 5	Property along Baltimore Avenue	434627.56	559171.12	0.17	0.60	3.44	12.05
ESR 6	Property along Ferryboat Lane	434701.01	558783.56	0.16	0.59	3.18	11.80
ESR 7	Property at Seven Houses	432334.01	557786.97	0.03	0.48	0.69	9.56
ESR 8	Property along Sulgrave Road	431863.91	558150.44	0.03	0.51	0.60	10.13
ESR 9	Property along Watcombe Close	431633.25	558996.97	0.03	0.50	0.57	10.09
ESR 10	East House Farm	431811.19	559417.59	0.03	0.50	0.62	9.99
ESR 11	Property along Follingsby Lane	432337.30	559964.76	0.06	0.53	1.24	10.67

Predicted NO_2 Concentrations and Deposition Rates for Existing Sensitive Ecological Receptor Points

1.6 The predicted NO_2 concentrations as a percentage of the relevant critical levels for the existing sensitive receptor points within the considered designated habitat sites, for each year of meteorological data, are shown in Figures 6.4/26 to 6.4/28, below. The highest results for the receptor points considered are underlined.

Figure 6.4/26: Barmston Pond LNR

	Nox Annual Mean as % of Critical Level					Nox 24 Hour Mean as % of Critical Level				
	2018	**2019**	**2020**	**2021**	**2022**	**2018**	**2019**	**2020**	**2021**	**2022**
ECO 1	0.28%	0.20%	0.25%	0.33%	0.21%	2.04%	1.95%	1.92%	2.39%	3.03%
ECO 2	0.31%	0.21%	0.29%	0.35%	0.22%	2.21%	1.71%	2.11%	2.32%	2.01%
ECO 3	0.33%	0.20%	0.35%	**0.37%**	0.26%	3.05%	1.29%	2.86%	4.30%	2.52%
ECO 4	0.26%	0.15%	0.28%	0.29%	0.27%	2.83%	1.93%	2.19%	**5.21%**	3.03%
ECO 5	0.21%	0.12%	0.23%	0.23%	0.19%	2.39%	0.98%	2.12%	3.62%	2.10%

Figure 6.4/27: Hylton Dene LNR

	Nox Annual Mean as % of Critical Level					Nox 24 Hour Mean as % of Critical Level				
	2018	**2019**	**2020**	**2021**	**2022**	**2018**	**2019**	**2020**	**2021**	**2022**
ECO 6	0.48%	0.47%	0.36%	0.55%	0.53%	2.77%	2.70%	3.10%	2.46%	**3.88%**
ECO 7	0.58%	0.48%	0.44%	0.57%	0.63%	3.09%	2.28%	2.63%	1.73%	2.86%
ECO 8	0.65%	0.50%	0.52%	0.57%	**0.66%**	3.32%	1.88%	2.34%	1.68%	2.14%
ECO 9	0.61%	0.48%	0.52%	0.55%	0.59%	2.13%	1.99%	2.32%	1.44%	2.02%
ECO 10	0.49%	0.49%	0.51%	0.54%	0.54%	1.58%	1.36%	1.89%	1.40%	1.43%

Figure 6.4/28: Northumbria Coast Ramsar site/SPA

	Nox Annual Mean as % of Critical Level					Nox 24 Hour Mean as % of Critical Level				
	2018	**2019**	**2020**	**2021**	**2022**	**2018**	**2019**	**2020**	**2021**	**2022**
ECO 11	0.02%	0.01%	0.01%	0.01%	0.01%	0.14%	0.20%	0.20%	0.10%	0.11%
ECO 12	0.02%	0.02%	0.01%	0.02%	0.02%	0.15%	0.24%	0.23%	0.12%	0.13%
ECO 13	0.02%	0.02%	0.02%	0.02%	0.02%	0.20%	0.13%	0.19%	0.15%	0.13%
ECO 14	0.03%	0.03%	0.02%	0.03%	0.03%	0.19%	0.23%	0.20%	0.22%	0.27%
ECO 15	0.09%	0.08%	0.09%	0.10%	0.09%	0.22%	0.31%	0.23%	0.36%	0.30%
ECO 16	0.08%	0.08%	0.09%	**0.10%**	0.08%	0.27%	0.29%	0.27%	**0.40%**	0.24%
ECO 17	0.07%	0.07%	0.08%	0.08%	0.07%	0.15%	0.18%	0.26%	0.29%	0.24%
ECO 18	0.06%	0.07%	0.07%	0.07%	0.07%	0.18%	0.19%	0.26%	0.28%	0.20%
ECO 19	0.06%	0.07%	0.07%	0.07%	0.06%	0.18%	0.21%	0.23%	0.24%	0.17%
ECO 20	0.05%	0.06%	0.06%	0.06%	0.06%	0.14%	0.16%	0.19%	0.24%	0.14%
ECO 21	0.04%	0.05%	0.05%	0.05%	0.05%	0.15%	0.15%	0.17%	0.17%	0.13%
ECO 25	0.03%	0.03%	0.04%	0.03%	0.03%	0.17%	0.12%	0.14%	0.18%	0.16%
ECO 26	0.03%	0.02%	0.03%	0.03%	0.03%	0.17%	0.16%	0.13%	0.13%	0.14%
ECO 27	0.02%	0.02%	0.02%	0.02%	0.03%	0.10%	0.10%	0.12%	0.12%	0.16%

1.7 As discussed within ES Chapter 6, High Woods Local Wildlife Site (LWS) lies outside of the Uniform Cartesian Receptor Grid included in the model and, therefore, the highest results for the nearby Barmston Pond Local Nature Reserve (LNR) have been applied to the LWS as a robust approach.

1.8 For the assessment of the Severn Houses LWS, the results of the closest grid point to the site have been used (432350, 557800). The highest modelling results were observed when using the 2021 meteorological data.

1.9 For the assessment of Elliscope Farm East/Hylton Bridge candidate LWS, the results of the closest grid point to the site have been used

(433550, 559850). The highest modelling results were observed when using the 2022 meteorological data.

1.10 The results for all LWSs considered in the assessment are included in Section 6.5 of ES Chapter 6.

1.11 The predicted nutrient nitrogen and acid deposition as a percentage of the relevant critical loads for the existing sensitive receptor points within the considered designated habitat sites, for each year of meteorological data, are shown in Figures 6.4/29 to 6.4/31, below. The highest results for the receptor points considered are underlined.

Figure 6.4/29: Barmston Pond LNR

	NN Deposition Rate as % of Critical Load					PC as % of CLMaxN				
	2018	**2019**	**2020**	**2021**	**2022**	**2018**	**2019**	**2020**	**2021**	**2022**
ECO 1	0.24%	0.18%	0.21%	0.28%	0.18%	0.06%	0.05%	0.06%	0.07%	0.05%
ECO 2	0.27%	0.18%	0.25%	0.30%	0.19%	0.07%	0.05%	0.07%	0.08%	0.05%
ECO 3	0.29%	0.17%	0.30%	**0.32%**	0.23%	0.07%	0.05%	0.08%	**0.08%**	0.06%
ECO 4	0.23%	0.13%	0.24%	0.25%	0.23%	0.06%	0.03%	0.06%	0.06%	0.06%
ECO 5	0.18%	0.10%	0.20%	0.20%	0.16%	0.05%	0.03%	0.05%	0.05%	0.04%

Figure 6.4/30: Hylton Dene LNR

	NN Deposition Rate as % of Critical Load					PC as % of CLMaxN				
	2018	**2019**	**2020**	**2021**	**2022**	**2018**	**2019**	**2020**	**2021**	**2022**
ECO 6	0.41%	0.40%	0.31%	0.48%	0.45%	0.11%	0.11%	0.08%	0.12%	0.12%
ECO 7	0.50%	0.41%	0.38%	0.49%	0.55%	0.13%	0.11%	0.10%	0.13%	0.14%
ECO 8	0.57%	0.43%	0.45%	0.49%	**0.57%**	0.15%	0.11%	0.12%	0.13%	**0.15%**
ECO 9	0.53%	0.42%	0.45%	0.47%	0.51%	0.14%	0.11%	0.12%	0.12%	0.13%
ECO 10	0.42%	0.43%	0.44%	0.47%	0.46%	0.11%	0.11%	0.12%	0.12%	0.12%

Figure 6.4/26: Northumbria Coast Ramsar site/SPA

	NN Deposition Rate as % of Critical Load					PC as % of CLMaxN				
	2018	**2019**	**2020**	**2021**	**2022**	**2018**	**2019**	**2020**	**2021**	**2022**
ECO 11	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 12	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 13	0.02%	0.02%	0.02%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 14	0.03%	0.02%	0.02%	0.03%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 15	0.07%	0.07%	0.08%	0.08%	0.08%	0.01%	0.01%	0.01%	0.01%	0.01%
ECO 16	0.07%	0.07%	0.08%	**0.09%**	0.07%	0.01%	0.01%	0.01%	**0.01%**	0.01%
ECO 17	0.06%	0.06%	0.07%	0.07%	0.06%	0.00%	0.00%	0.01%	0.00%	0.00%
ECO 18	0.05%	0.06%	0.06%	0.06%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 19	0.05%	0.06%	0.06%	0.06%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 20	0.05%	0.05%	0.05%	0.05%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 21	0.04%	0.04%	0.04%	0.04%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 25	0.03%	0.02%	0.03%	0.02%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 26	0.03%	0.02%	0.03%	0.02%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
ECO 27	0.02%	0.02%	0.02%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%

1.12 The results for all LWSs and candidate LWSs considered in the assessment are included in section 6.5 of ES Chapter 6.