Connah's Quay Low Carbon Power

Environmental Statement Volume IV

Appendix 8-C: Air Quality Traffic Emissions Assessment (Tracked)

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Prepared for:
Uniper UK Limited

Prepared by:
AECOM Limited

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1.1 Introduction

1.1.1 This technical appendix of the Environmental Statement supports **Chapter 8: Air Quality** (**EN010166/APP/6.2.8**). For more details about the Connah's Quay Combined Cycle Gas Turbine (CCGT) fitted with Carbon Capture Plant (CCP) (hereafter referred to as the Proposed Development) refer to **Chapter 4: Proposed Development** (**EN010166/APP/6.2.4**).

1.1.2 Emissions to air from the Proposed Development have the potential to adversely affect human health and sensitive ecosystems if not appropriately controlled. This technical appendix identifies and proposes measures to address the potential impacts and effects of the Proposed Development on air quality from road traffic emissions during construction, operation (including maintenance) and decommissioning.

1.1.3 The magnitude of air quality impacts at sensitive human receptors have been considered for pollutants emitted from the construction, operation (including maintenance) and decommissioning of the Proposed Development on local air quality. The impact of emissions on sensitive ecological receptors has been considered in the context of relevant critical loads or critical levels for all identified ecological receptors.

1.2 Scope

1.2.1 The assessment considers impacts from the predicted construction peak, (month 36, under a simultaneous construction phase approach) when the workforce is predicted to be at its peak, namely 2034. For operations, the assessment considers the opening year, namely 2036.

1.2.2 The impacts from operational traffic emissions and plant operations are presented in **Appendix 8-D: Air Quality Operational Assessment** (**EN010166/APP/6.4**).

Study Area

1.2.3 For potential impacts due to changes in pollutant concentrations associated with changes in road traffic flows, the study area for potential impacts on sensitive receptors is 200 m from the road centreline of all road links associated with the Proposed Development, as per LA105 (Ref 1).

Cumulative Impacts

1.2.4 Cumulative impacts from existing sources of pollution in the area are accounted for in the adoption of site-specific background pollutant concentrations from archive sources and a programme of project-specific baseline air quality monitoring in proximity to Proposed Development. It is recognised, however, that there is a potential impact on local air quality from emission sources which may not have been present at the time of the survey.

1.2.5 The full list of short-listed proposed schemes to be considered for the Proposed Development is detailed within **Chapter 24: Cumulative and Combined Effects** (**EN010166/APP/6.2.24**).

1.2.6 The traffic data used in this assessment includes predicted traffic growth on modelled roads between the current and the future year baselines. The methodology to determine the growth in traffic on the local road network is described in **Chapter 10: Traffic and Transport** (**EN010166/APP/6.2.10**). The predicted growth included in the traffic data does account for increases in traffic flows associated with other committed developments in the area. Therefore, the construction traffic air quality assessment of the Proposed Development is inherently cumulative.

Sources of Information

1.2.7 The information that has been used within this preliminary assessment includes pertinent information from:

- **Chapter 4: Proposed Development** (**EN010166/APP/6.2.4**);
- **Chapter 5: Construction Programme and Management** (**EN010166/APP/6.2.5**);
- **Figure 3-3: Areas Described in the ES** (**EN010166/APP/6.3**);
- Ordnance Survey mapping;
- construction traffic data as reported in **Chapter 10: Traffic and Transport** (**EN010166/APP/6.2.10**); and
- baseline air quality data from AECOM diffusion tube measurements within the air quality study area and from published sources, including relevant local authorities (as defined in **Appendix 8-A: Baseline Air Quality Information** (**EN010166/APP/6.3**)).

1.3 Construction Traffic Emissions Assessment

Introduction

1.3.1 For the construction traffic emissions assessment, all affected roads have been assessed at a 'detailed level' of assessment. As described in Institute of Air Quality Management (IAQM) Guidance (Ref 2), a 'detailed level' assessment uses dispersion modelling to estimate pollutant concentrations more accurately, taking into account additional variables. The detailed assessment of local air quality reported herein has used the Cambridge Environmental Research Consultants (CERC) Atmospheric Dispersion Modelling System (ADMS) Roads dispersion model (version 5.0.1) to predict road pollutant contributions at identified sensitive receptors.

1.3.2 Predictions have been made for the following:

- baseline year (2023);
- the peak construction year ('future year') (2034) with the Proposed Development construction work;
- the peak construction year ('future year') (2034) without the Proposed Development construction work;
- the peak construction year ('future year') (2034) without the Proposed Development construction work, with maintenance work on the existing Connah's Quay Power Station;
- the first operational year ('future year') (2036) with the Proposed Development operational traffic; and
- the first operational year ('future year') (2036) without the Proposed Development operational traffic.

1.3.3 On the basis of these predictions, the change in key pollutant concentrations (NO_2, PM_{10} and $PM_{2.5}$) associated with the Proposed Development have been established.

1.3.4 Dispersion model performance within the study area has been verified by comparing the concentration values predicted for the baseline scenario and baseline air quality measurement data. Where systematic bias is evident in the base year verification, an adjustment factor has been calculated (as set out in the Bias Adjustment of Road Contribution section of this Appendix) and applied to bring modelled concentrations more in line with measured concentrations.

1.3.5 The magnitude of impacts from the Proposed Development are calculated using the modelled predictions of pollutant concentrations for the scenarios considered, and Defra Local Air Quality Management (LAQM) technical guidance and tools, including the current version of the NO_x to NO_2 conversion approach and background maps. Predictions are also informed by two-way 24-hour Annual Average Daily Traffic (AADT) flow data as sourced from **Chapter 10: Traffic and Transport** (**EN010166/APP/6.2.10**), and hourly sequential meteorological data from a representative meteorological station.

1.3.6 Further details of the assessment methodology including the inputs used in the ADMS-Roads model (including meteorological observation data), model post-processing (e.g. NO_x to NO_2 conversion) and the approach taken to model verification (including details all measurement locations used in the verification process) are presented in the following sub-sections.

1.3.7 Representative sensitive receptors (e.g. residential properties and ecological sites) have been selected for assessment within the local air quality assessment. These include those sensitive receptors located closest to the study area for construction and operational effects.

1.3.8 The predicted air quality impacts of the Proposed Development are evaluated against relevant national, regional and local air quality planning policy. An evaluation of the significance of the local air quality assessment findings at sensitive receptors for human health has been undertaken using professional judgement as promoted in IAQM guidance. It is considered that the determination of significance using the IAQM guidance is more conservative for the assessment of effects from road traffic emissions of the Proposed Development than the use of significance criteria provided in National Highways (formerly Highways England) guidance for road traffic schemes, where a significant effect can only occur when there is an exceedance of an air quality standard in either future baseline or future construction phase scenarios.

1.3.9 The significance of the effects on ecological receptors, including the magnitude of change in NO_x, NH_3 and nitrogen deposition, are considered as part of the ecology and nature conservation assessment (see **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**)) and within the **Report to inform the Habitats Regulations Assessment** (**HRA)** (**EN010166/APP/6.12**).

1.3.10 Although contributions to acid deposition from traffic would be considered in combination with stack emissions for the operational phase, it is not typically considered for phases with traffic-only emissions, such as for construction and decommissioning. The widely accepted approach is to focus on nitrogen deposition and critical levels for road traffic-only assessments, as presented for example in the LA105 (Ref 1).

Screening Criteria

1.3.11 The construction phase traffic assessment considers the impact of emissions associated with additional heavy-duty vehicles (HDV) (vehicles >3.5 tonnes (t) in weight) and light duty vehicles (LDV) (vehicles <3.5 t in weight) introduced to the local road network due to construction work associated with the Proposed Development, including those associated with the import and export of materials to and from Proposed Development and the commuting of contractors.

1.3.12 The screening of traffic data has been undertaken using the approach set out by IAQM guidance, to identify potentially affected road links. The IAQM criteria are summarised in **Table 1.**

1.3.13 The construction traffic assessment considers those road links where a change in traffic flows above the criteria identified in **Table 1** occurs in the immediate area around the Proposed Development. At junctions, other adjoining road links have been included where the adjoining route flows are below the selection criteria. There are no Air Quality Management Areas (AQMAs) declared within or adjacent to the study area (the closest being 12 km form the Main Development Area), consequently only roads with predicted changes to annual average daily total (AADT) flows of more than 500 veh/day in LDVs or 100 veh/day in HDVs are considered to be within the construction study area. The study area is shown in **Figure 8-1** (**EN010166/APP/6.3**).

Table 1: Screening Criteria for Determining the Study Area

If the development would:	Indicative criteria to proceed to an air quality assessment
Cause a significant change in LDV traffic flows on local roads with relevant receptors. (LDV = cars and small vans <3.5 t gross vehicle weight).	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
Cause a significant change in HDV flows on local roads with relevant receptors. (HDV = heavy goods vehicles (HGV) + buses >3.5 t gross vehicle weight)	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.

Modelled Scenarios

1.3.14 A quantitative assessment of the impact of exhaust emissions from additional road traffic has been undertaken for the following scenarios:

- **2023** Baseline Scenario (for model verification process) (Base);
- **2034** Future Construction Year Base + Committed Developments (Future Construction Baseline);
- **2034** Future Construction Year Base + Committed Developments + Peak Construction Scenario (Future Year with Proposed Development Construction), hereafter referred to as the 'main construction scenario';
- **2034** Future Construction Year Base + Committed Developments + Peak Construction Scenario + Existing Connah's Quay Power Station Maintenance (Future Year with Proposed Development Construction and Existing Connah's Quay Power Station Maintenance), hereafter referred to as the 'construction sensitivity scenario';
- **2036** Future Operational Year Base + Committed Developments (Future Operational Baseline); and
- **2036** Future Operational Year Base + Committed Developments + Peak Operational Scenario (Future Year with Proposed Development Operational).

Model Inputs

1.3.15 The general model conditions that have been used in the assessment of road traffic emissions are summarised in **Table 2**. Other more detailed data used to model the dispersion of emissions is considered below.

Table 2: General ADMS Roads Model Conditions

Variable	Input
Surface Roughness at source	0.4 m
Minimum Monin-Obukhov length for stable conditions	10 m
Receptors	Selected discrete receptors
Receptor location	X,Y co-ordinates determined by GIS. The height of residential receptors would be set at 1.5 m, ecological receptors at 0 m
Emissions	NO_x, PM_{10} and $PM_{2.5}$
Emission Factors	Emission Factor Toolkit version 13.0 for 2023 for baseline, construction and operational year (2034 and 2036) scenarios
Meteorological Data	1 year of hourly sequential data, Hawarden Airport meteorological site (2023)
Emission Profiles	None used
Terrain Types	Flat terrain
Model Output	Long-term annual mean NO_x concentration ($\mu g/m^3$) Long-term annual mean PM_{10} concentration ($\mu g/m^3$) Long-term annual mean $PM_{2.5}$ concentration ($\mu g/m^3$)

1.3.16 As per the IAQM guidance (Ref 3), only the annual mean NOx concentration is used in assessments for ecological sites, unless specifically required by a regulator, as opposed to also including the daily maximum.

Traffic Data

1.3.17 The traffic data used in this assessment takes the form of 2-way AADT. The future construction base year is 2034. The construction base year is the period where the number of construction vehicles accessing the Proposed Development would peak and is considered to be a worst-case scenario for assessing potential effects due to construction traffic. The future operational base year is 2036. The operational base year is the first operational year of the Proposed Development. 2-way 24hr AADT traffic flows are presented in **Table 3** (refer to **Chapter 10: Traffic and Transport** (**EN010166/APP/6.2.10**) for further details).

Table 3: Road Traffic Data

Road name	Average Speed (miles/h)	Baseline		Future construction baseline and committed developments		Future Construction Year with construction traffic and committed developments		Future Construction Year with construction traffic, maintenance traffic and committed developments		Future operational baseline and committed developments		Future Year with Proposed Development and committed developments	
		Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV
Kelsterton Road	**30**	290	55	316	60	1,930	300	2,428	300	320	61	441	72
A548 (West of Access to Main Development Area)	**53.8**	14,081	1,030	15,323	1,120	15,875	1,120	16,048	1,120	15,515	1,134	15,554	1,134
A548 (East of Access to Main Development Area)*	**53.8***	14,386	953	15,655	1,037	16,781	1,277	16,886	1,277	15,851	1,050	15,886	1,061
B5129	**24.1**	9,065	1,113	9,948	1,211	10,555	1,211	10,775	1,211	10,072	1,226	10,120	1,226

Road name	Average Speed (miles/h)	Baseline		Future construction baseline and committed developments		Future Construction Year with construction traffic and committed developments		Future Construction Year with construction traffic, maintenance traffic and committed developments		Future operational baseline and committed developments		Future Year with Proposed Development and committed developments	
		Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV	Total AADT, 7-Day	HDV
Kelsterton Lane	**35.0**	1,065	119	1,159	130	1,631	130	1,801	130	1,173	132	1,211	132
Allt Goch Lane	**22.2**	131	20	143	21	151	21	151	21	145	22	145	22
Golftyn Lane	**20.2**	6,631	585	7,358	636	7,358	636	7,358	636	7,449	644	7,449	644
Mold Road	**20.0**	7,216	550	7,927	598	7,927	598	7,927	598	8,025	606	8,025	606

*No speed data available. Speed data determined for A548 (West of Access to Main Development Area) considered to be representative of this road.

Emissions Data

1.3.18 The magnitude of road traffic emissions for the baseline and with development scenarios have been calculated from traffic flow data using the Defra's current emission factor database tool EFT v13.0. The assessment considers the construction and operational phases impact of road traffic emissions at receptors adjacent to roads in the vicinity of the Proposed Development.

Modelled Domain – Discrete Receptors

1.3.19 In line with guidance and standard practice, representative worst-case receptors located within 200 m of road links associated with the Proposed Development (i.e., the study area for the traffic assessment) were screened in accordance with the criteria set out in **Table 1**. For human health receptors, receptor locations represent the nearest façade of a residential property, school or medical facility to the road links considered. For ecology receptors, they represent the nearest part of each designated area to the road links, with additional receptor points set in a transect with increasing distance from the road links, to demonstrate the spatial variation in predicted impacts across each designated site.

1.3.20 The human health receptors for which the impact of road traffic emissions have been predicted are listed within in **Table 4** and are shown on **Figure 8-2: Operational Phase Assessment – Air Quality Study Area and Human Health Receptors** (**EN010166/APP/6.3**).

Table 4: Traffic Human Health Receptors

Receptor ID	X (m)	Y (m)	Description
R1	327170	371241	Kelsterton Road, Rockcliffe, Flint, Connah's Quay, Flintshire, Wales, CH6 5SJ
R2	327152	371210	Chester Road, Oakenholt, Flint, Connah's Quay, Flintshire, Wales, CH6 5SJ
R5	327880	370743	Kelsterton Road, Rockcliffe, Connah's Quay, Flintshire, Wales, CH5 4BJ
R6	327972	370700	Connah's Quay, CH5 4BL
R11	325943	371334	Leaderbrook Drive, Oakenholt, Flint, CH6 5ST
R12	325928	371585	Leaderbrook Drive, Oakenholt, Flint, CH6 5ST
R13	325967	371792	Leaderbrook Drive, Oakenholt, Flint, CH6 5ST,
R14	325966	371823	Chester Road, Oakenholt, Flint, Flintshire, Wales, CH6 5WF
R15	328454	370344	Church Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4AS
R19	327314	369848	Top-y-fron Hall, Kelsterton Lane, Connah's Quay, Northop Hall, Flintshire, Wales, CH6 5TF
R20	326567	369690	Oakenholt Lane, Rockcliffe, Connah's Quay, Northop Hall, CH6 5SU
R22	328824	370107	Church Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4AQ
R23	328830	370114	Church Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4AQ
R26	328634	369331	Lon Dderwen, Connah's Quay, Deeside CH5 4WG
R27	325516	372175	St David's, Croes Attilla, Flint, CH6 5SP
R28	324919	372091	St Richard Gwyn Roman Catholic High School, Albert Avenue, Flint, CH6 5JZ
R29	324990	372645	Ysgol Gymraeg Croes Atti, Chester Road, Flint, CH6 5DU
R34	329678	369534	High Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4DJ
R35	329955	369652	Dock Road, Connah's Quay, CH5 4EF
R36	329953	369351	High Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4DJ
R37	329600	369081	Mold Road, Connah's Quay, Flintshire, Wales, CH5 4QN
R39	328165	368716	Mold Road, Connah's Quay, CH5 4QN
R43	331087	366723	Overlea Drive, Deeside CH5 3HS

1.3.21 The ecological receptors for which the impact of road traffic emissions have been predicted are listed in **Table 5** (TE = Traffic Ecological Receptor) and are shown on **Figure 8-3: Operational Phase Assessment – Air Quality Study Area and Ecological Receptors** (**EN010166/APP/6.3**). These receptors have been chosen to represent the closest point to the road, and have been modelled at increasing distances within a transect that extends up to a distance of 200 m from the edge of the road carriageway.

Table 5: Modelled Ecological Receptors

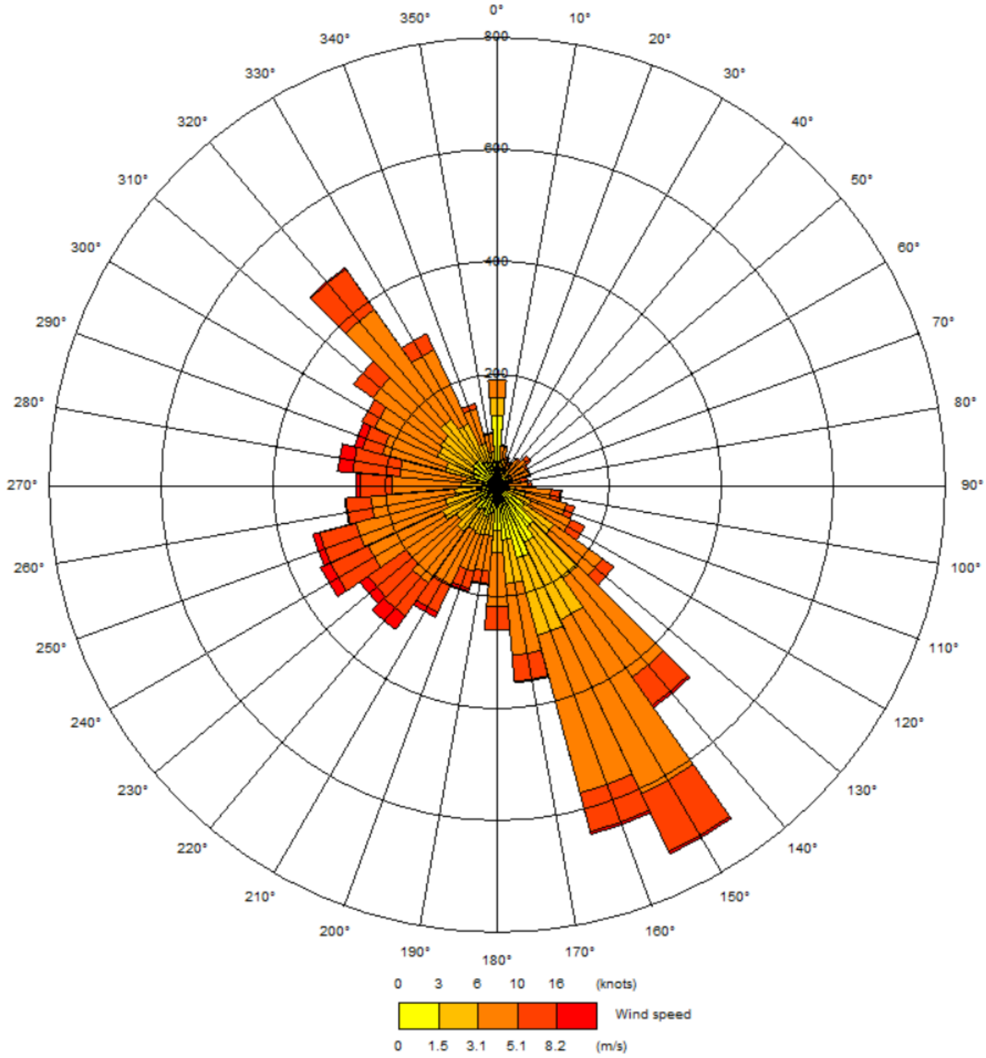
Receptor ID	X (m)*	Y (m)*	Description
TE1	326251.9	371462.8	Ancient Woodland
TE2	325213.5	370708.6	Ancient Woodland
TE3	327512.8	369146.2	Ancient Woodland
TE4	327120.5	369346.4	Ancient Woodland
TE5	327330.0	370020.6	Ancient Woodland
TE6	327368.2	370073.8	Ancient Woodland
TE7a	328085.7	368703.8	Connah's Quay Ponds and Woodland Site of Special Scientific Interest (SSSI)
TE7b	328423.4	368613.1	Connah's Quay Ponds and Woodland SSSI
TE7c	328894.3	368708.5	Connah's Quay Ponds and Woodland SSSI
TE8a	326300.4	371751.3	Dee Estuary Special Area of Conservation (SAC)
TE8b	328631.1	370781.3	Dee Estuary SAC
TE8c	329122.7	370046.0	Dee Estuary SAC

*Coordinate of the closest point to the modelled road, other points were also model to form a transect up to 200 m from the road's edge.

Meteorological Data

1.3.22 The model runs carried out for the Proposed Development used hourly sequential data from Hawarden Airport, year 2023, consistent with the year chosen to verify the performance of the model against measured NO_2 concentrations. This meteorological site is located approximately 9 km south-east of the study area with a measured prevailing wind of typically between 3 m/s and 5 m/s from south-south-east. A wind rose for this site is presented in **Plate 1**.

Plate 1: Hawarden 2023 Wind Rose



Background Concentrations

1.3.23 Background concentrations used in the assessment for NO_2 were taken from the three-month diffusion tube monitoring survey undertaken for the Proposed Development (as detailed in **Appendix 8-A: Baseline Air Quality Information** (**EN010166/APP/6.3**), with the highest concentration at any of the background locations selected as representative. Generally, measured background concentrations can be considered to be more representative than modelled Defra backgrounds (Ref 4). The project-specific background concentrations have been compared against local authority and Defra background, which has suggested no uplift is required. Additionally, to provide for a conservative assessment, 2023 background concentrations have been used in the assessment of the construction and operational phases, even though background concentrations are predicted to go down in future years, according to the Defra background maps (Ref 4).

1.3.24 As no representative measurement data is available for PM_{10} and $PM_{2.5}$, annual mean background concentrations were taken from Defra's 2018 baseline 1 km x 1 km background maps (Ref 4) and adjusted using Defra's adjustment tool removing (Ref 5) emissions from road traffic for primary or trunk A roads. The data used in the assessment is presented for the centre of each 1 km x 1 km grid square in **Table 6.** Modelled background concentration values are only available up to 2030, therefore 2030 concentrations would be considered representative of the construction and operational scenarios (2034 and 2036). However, as for NO_2, 2023 background concentrations have been used in the assessment of the future years, to provide a reasonable worst-case assessment.

1.3.25 **Table 6** shows lower concentrations are expected in 2030 so using 2023 backgrounds results in higher total pollutant concentrations.

1.3.26 In relation to ecosystems, for oxides of nitrogen (NOx) and nitrogen deposition, background concentrations for designated sites have been sourced from the UK Air Pollution Information System (APIS) website (Ref 6) and presented in **Table 7**.

Table 6 Projected and Measured Background Concentrations

Grid Square	2023 NO_2 (μg/m³) *	2023 PM_{10} (μg/m³)	2023 $PM_{2.5}$ (μg/m³)	2034 PM_{10} (μg/m³)	2034 $PM_{2.5}$ (μg/m³)	2036 PM_{10} (μg/m³)	2036 $PM_{2.5}$ (μg/m³)
327500_371500	6.5	9.7	5.6	8.9	5.0	8.8	4.9
326500_371500	6.5	9.6	5.5	9.3	4.9	8.8	4.8
325500_371500	6.5	10.1	5.7	9.6	5.0	9.3	4.9
326500_370500	6.5	9.5	5.5	9.2	4.8	8.7	4.7
327500_370500	6.5	10.1	5.7	9.5	5.1	9.3	5.0
328500_370500	6.5	10.5	6.2	10.0	5.5	9.6	5.4
328500_369500	6.5	11.1	6.8	10.8	6.0	10	5.8
324500_372500	6.5	11	6.6	10.7	5.7	10	5.6
324500_370500	6.5	9.2	5.4	9.2	4.8	8.4	4.7
329500_369500	6.5	11	6.8	10.9	6.0	9.9	5.8
328500_368500	6.5	10.8	6.5	10.5	5.7	9.8	5.6

Grid Square	2023 NO_2 (µg/m³) *	2023 PM_{10} (µg/m³)	2023 $PM_{2.5}$ (µg/m³)	2034 PM_{10} (µg/m³)	2034 $PM_{2.5}$ (µg/m³)	2036 PM_{10} (µg/m³)	2036 $PM_{2.5}$ (µg/m³)
326500_369500	6.5	9.7	5.5	9.6	4.8	8.9	4.7
330500_368500	6.5	11.3	7.1	10.7	6.2	10.2	6.0
324500_371500	6.5	10.2	5.8	9.9	5.1	9.3	5.0
325500_372500	6.5	9.9	5.8	9.7	5.1	9.1	5.0
327500_369500	6.5	9.9	5.7	9.6	5.0	9.1	4.9

* Measured

Table 7: Apis Background Concentrations at Sensitive Traffic Ecological Receptors

Receptor ID	Closest Coordinate to the Road		Site	Background NOx Concentrations (µg/m³)	Background NO_x Deposition (kgN/ha/yr)
	X	Y			
TE1	326251.9	371462.8	Ancient Woodland	9.6	28.2
TE2	325213.5	370708.6	Ancient Woodland	6.5	28.7
TE3	327512.8	369146.2	Ancient Woodland	7.1	29.5
TE4	327120.5	369346.4	Ancient Woodland	7.1	29.5
TE5	327330.0	370020.6	Ancient Woodland	7.5	28.9
TE6	327368.2	370073.8	Ancient Woodland	7.5	28.9

Receptor ID	Closest Coordinate to the Road		Site	Background NOx Concentrations (µg/m³)	Background NO_x Deposition (kgN/ha/yr)
	X	Y			
TE7a	328085.7	368703.8	Connah's Quay Ponds and Woodland SSSI	8.6	30.6
TE7b	328423.4	368613.1	Connah's Quay Ponds and Woodland SSSI	8.6	30.6
TE7c	328894.3	368708.5	Connah's Quay Ponds and Woodland SSSI	8.6	30.6
TE8a	326300.4	371751.3	Dee Estuary SAC	9.6	16.0
TE8b	328631.1	370781.3	Dee Estuary SAC	9.0	16.2
TE8c	329122.7	370046.0	Dee Estuary SAC	12.0	16.8

Consideration of Terrain

1.3.27 Emissions from road traffic make the greatest contribution to pollutant concentrations at sensitive receptors adjacent to the roadside. For this reason, there is not normally a large variation in height between the emission source and residential properties next to the roads included in the model. Therefore, terrain is not included in the road traffic modelling assessment.

1.3.28 In addition, the potential influence of gradient on vehicle emission rates has been taken into account where appropriate. A 3% gradient has been applied for Mold Road between High Street and Hollowbrook Drive. A 7% gradient has been applied for Mold Road between Hollowbrook Drive and Kelsterton Lane.

NO_x to NO_2 Conversion

1.3.29 To accompany the publication of a previous version of the guidance document LAQM.TG(22) (Ref 7), a NO_x to NO_2 converter was made available as a tool to calculate the road NO_2 contribution from modelled road NO_x contributions. The tool is a Microsoft Excel spreadsheet which utilises borough specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NO_x. Version 8.1 (Ref 8) of this tool has been used to calculate the total NO_2 concentrations at receptors from the modelled road NO_x contribution and associated background concentration. Due to the location of the Proposed Development, Sir y Fflint - Flintshire has been specified as the local authority and the 'All other non-urban UK traffic' mix selected.

Bias Adjustment of Road Contribution NO_x, NO_2, PM_{10} and $PM_{2.5}$

1.3.30 The modelled road NO_x contributions from the ADMS-Roads model has been adjusted for bias following the method described in LAQM.TG(22) (Ref 7). The purpose of this exercise is to bring the baseline model performance in line with known pollutant concentrations at set locations within the model domain. The level of adjustment identified in the baseline scenario is then applied to future scenarios.

1.3.31 Monitoring data used for model verification typically includes that sourced from local authorities, if appropriate, and data gathered by project-specific baseline surveys. A baseline NO_2 monitoring survey has been undertaken for the Proposed Development which included 10 monitoring locations. From these 10 monitoring locations, seven were on the roadside of roads included in the model and therefore these were appropriate to use in the construction road traffic model verification.

1.3.32 Where diffusion tube monitoring survey has taken place for less than 12 months, it is necessary to annualise the monitoring results using the method described in LAQM.TG(22) (Ref 7) in order to obtain a projected annual mean concentration for the existing baseline year of the assessment. This provides a monitored dataset against which modelled concentrations can be directly compared.

1.3.33 A three-month diffusion tube monitoring survey of the study area commenced in February 2024, in order to gather data on the ambient concentrations of NO_2 at representative human health and background locations. The data collected relevant to the assessment is shown in **Table 8**.

1.3.34 Annualisation involves comparing the measured period mean diffusion tube concentrations from the survey to concentrations measured at nearby (<50 km away) background continuous monitoring stations over the same period (February 2024 – May 2024). Measured period mean diffusion tube concentrations are adjusted using the Ra factor, which is the average of ratios between the period mean (Pm) and annual mean (Am) for each continuous monitor. Diffusion tubes concentrations are then adjusted using a national bias adjustment factor which accounts for systematic bias arising in the treatment of diffusion tubes during laboratory analysis. 2023 was used as it is the most recent full calendar year. More details are included in **Appendix 8-A: Baseline Air Quality Information** (**EN010166/APP/6.3**). The resultant annual mean NO_2 concentrations are presented in **Table 8**.

Table 8: Diffusion Tube Data

Site	X	Y	Unadjusted Period Mean NO_2 (µg/m^3)	Annualised and Bias Adjusted Annual Mean NO_2 (µg/m^3)
DT1	327119	371220	31.5	26.6
DT2	327779	370830	22.7	19.2
DT3	327986	370643	15.1	12.8
DT4	327403	371099	13.3	11.3
DT5	328292	370258	12.5	10.6
DT6	328728	370172	18.3	15.5
DT7	324963	371660	6.9	5.8
DT8	325688	371573	7.6	6.5
DT9	328176	369287	7.3	6.2
DT10	328180	369121	17.6	14.9

1.3.35 A review of existing and publicly available local authority data has been undertaken and found that no measurement locations were suitable for model verification.

1.3.36 Verification calculations yielded a bias adjustment factor of 1.62 with a Root Mean Square Error (RMSE) of 2.1 µg/m^3. An RMSE of less than 10% of the air quality objective (10% of 40.0 µg/m^3 is 4.0 µg/m^3) is considered ideal and an RMSE of less than 25% of the air quality objective (25% of 40.0 µg/m^3 is 10.0 µg/m^3) is considered acceptable. The adjusted model used two zones with bias adjustment factors for areas with distinct characteristics. One zone being representative of the area surrounding the Proposed Development (Zone 1) around the dual carriage way and another zone representative of the outer urban area (Zone 2). A summary of the bias adjustment process for both zones is presented in **Table 9**.

1.3.37 As some monitoring locations are close to the kerb but with no receptors at a similar distance, the concentration values have also been distance corrected for calibration (verification) purposes to a virtual receptor location at the same distance back from the carriageway as the nearest sensitive receptor to the road link (DT1 and DT10).

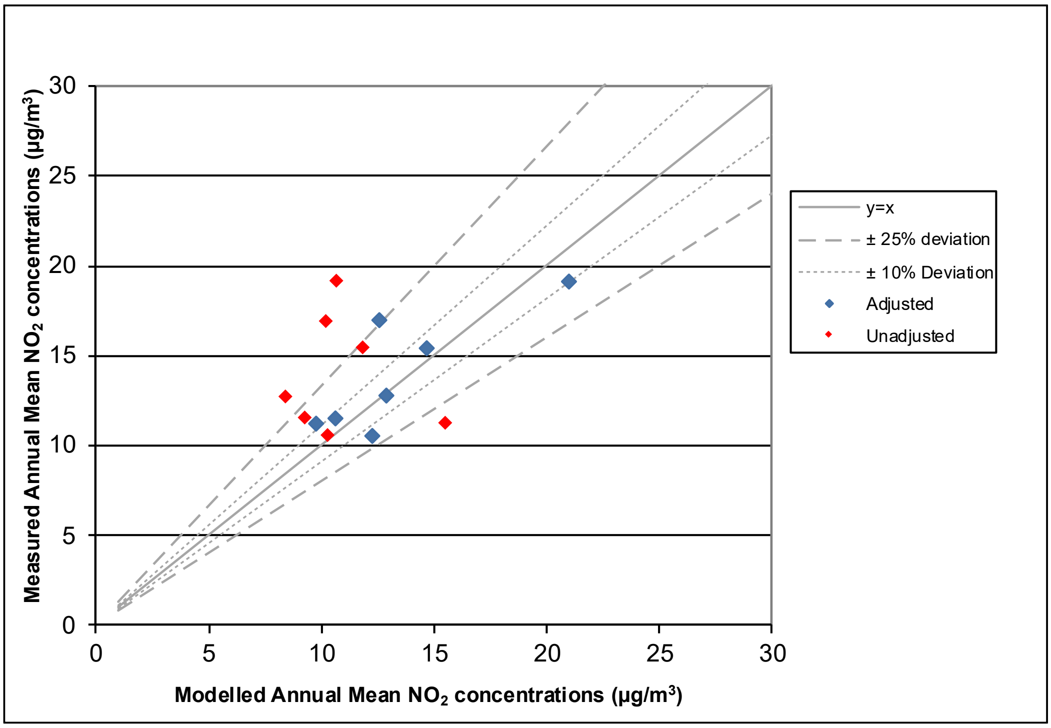
Table 9: Summary of the Bias Adjustment Process

Tube ID	Zone	2023 Annualised Monitored Road NOx (µg/m^3)	2023 Annual Mean Modelled Road NOx Before Adjustment (µg/m^3)	2023 Annual Mean Modelled Road NOx After Adjustment (µg/m^3)	Verification Factor for Road NOx Adjustment
DT1*	Zone 1	22.6	7.3	12.8	1.75
DT4		9.9	3.9	6.8	
DT2		27.8	18.5	32.4	
DT3	Zone 2	13.2	8.6	13.5	1.57
DT5		8.4	7.7	12.1	
DT6		19.2	11.1	17.4	
DT10*		10.6	5.4	8.5	

*Distance corrected

1.3.38 The red dots (on the graph below) show the variation of the unadjusted modelled concentration of total annual mean NO_2 at the measurement locations in the whole traffic study area. The blue dots show the adjusted modelled concentration of total annual mean at the measurement locations. The comparison of measured and modelled concentrations here suggests that the model under-predicted at various locations in both zones. Therefore, bias adjustment factors were required; the factor of 1.67 was applied to the modelled road NO_X in the area close to the Proposed Development and 1.54 in the outer urban area.

Plate 2: Modelled NO_2 vs Monitored NO_2 for the Road Traffic study area



1.3.39 The verification factor was applied to the predicted road NO_x concentrations prior to the conversion of road NO_x to total NO_2 concentrations at the receptors.

1.3.40 There is insufficient roadside measurement data for the primary pollutants PM_{10} or $PM_{2.5}$ within the study area. Therefore, the same bias adjustment factor derived for the modelled contributions of the primary pollutant NO_x has been applied to the modelled road PM_{10} and $PM_{2.5}$ contributions, as recommended in LAQM.TG (22) (Ref 7).

Predicting the Number of Days in Which the NO_2 Hourly Mean Objective is Exceeded

1.3.41 Research projects completed on behalf of Defra and the Devolved Administrations, have concluded that the hourly mean NO_2 objective is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 μg/m^3.

1.3.42 In 2003, Laxen and Marner (Ref 9) concluded: '*…local authorities could reliably base decisions on likely exceedances of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 μg/m^3 and above.*'

1.3.43 The findings presented by Laxen and Marner (Ref 9) are further supported by AEA Technology (AEAT) (Ref 10) who revisited the investigation to complete an updated analysis including new monitoring results and additional monitoring sites. The recommendations of this report are: '*Local authorities should continue to use the threshold of 60 μg/m^3 NO_2 as the trigger for considering a likely exceedance of the hourly mean nitrogen dioxide objective.*'

1.3.44 Therefore, this assessment evaluates the likelihood of exceeding the hourly mean NO_2 objective by comparing predicted annual mean NO_2 concentrations at all receptors to an annual mean equivalent threshold of 60 µg/m^3. Where predicted concentrations are below this value, it can be concluded that the hourly mean NO_2 objective (200 µg/m^3 NO_2 not to be exceeded more than 18 times per year) would be achieved.

Predicting the Number of Days in Which the PM_{10} 24-Hour Mean Objective is Exceeded

1.3.45 The guidance document LAQM.TG(03) (Ref 11) sets out the method by which the number of days in which the PM_{10} 24hr objective is predicted to be exceeded can be obtained based on a relationship with the predicted PM_{10} annual mean concentration. The most recent guidance LAQM.TG(22) (Ref 7) suggests no change to this method. As such, the formula used within this assessment is:

No. PM_{10} 24-hour mean exceedances = $-18.5 + 0.00145 \times C^3 + (206/C)$

Where C is the annual mean concentration of PM_{10}

Specialised Model Treatments

1.3.46 No specialised model treatments have been used in the assessment of construction and operational road traffic emissions.

Calculation of Nitrogen Deposition for Ecological Receptors

1.3.47 Conversion factors for calculating nitrogen deposition from modelled NO_2 are found in the IAQM's guide to the assessment of air quality impacts on designated nature conservation sites 2020 (Ref 3).

1.3.48 The conversion rates and factors used in the assessment are detailed in **Table 10**.

Table 10: Conversion factors – calculation of nutrient nitrogen deposition

Pollutant	Deposition velocity Grassland (m/s)	Deposition velocity Forests (m/s)	Conversion factor (µg/m^3/s to Kg/ha/yr)
NO_2	0.0015	0.003	96

Evaluation of Significance

1.3.49 The criteria used for the evaluation of the significance of air quality effects are detailed in paragraphs 8.3.37 to 8.3.49 of **Chapter 8: Air Quality** (**EN010166/APP/6.2.8**).

Results of the Construction Traffic Assessment

1.3.50 The change in annual mean NO_2 concentrations that are predicted to occur due to traffic associated with Proposed Development construction works at the selected sensitive receptors, are presented in **Table 11**. Any variations in the addition of the change to the baseline concentrations are due to rounding.

1.3.51 In the main construction scenario, the maximum predicted change in annual mean NO_2 concentrations at the selected sensitive receptors is 0.7 µg/m^3, which would occur in the vicinity of receptors on Kelsterton Road. The reported change in NO_2 concentration at this location is due to the impact of emissions from construction road traffic.

1.3.52 In the construction sensitivity scenario, the maximum predicted change in annual mean NO_2 concentrations at the selected sensitive receptors is 0.8 µg/m^3, which would occur in the vicinity of receptors on Kelsterton Road. The reported change in NO_2 concentration at these locations is due to the impact of emissions from construction road traffic.

1.3.53 The total annual mean NO_2 at all the receptors would remain below the annual mean NO_2 Air Quality Assessment Level (AQAL) in both scenarios, with the highest total concentration of 10.3 µg/m^3 in the main construction scenario and construction sensitivity scenario reported at receptors along Church Street. Therefore, the change is not predicted to lead to a risk of the annual mean or the hourly mean AQAL being exceeded.

1.3.54 The significance of the predicted change in annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations during the construction of the Proposed Development construction, in accordance with the methodology set out in **Chapter 2: EIA Methodology** (**EN010166/APP/6.2.2**) is presented in **Chapter 8: Air Quality** (**EN010166/APP/6.2.8**).

Table 11: Predicted change in annual mean NO_2 concentrations at discrete receptors due to construction road traffic emissions, with comparison against AQAL

Receptor ID	2023 Baseline ($\mu g/m^3$)	2034 Baseline ($\mu g/m^3$)	2034 Construction Scenario ($\mu g/m^3$)	Change in NO_2 Concentration (2034 Baseline – 2034 Scenario) ($\mu g/m^3$)	Change as % of AQAL (%)
R1	10.1	7.6	8.3	0.7	1.7%
R2	12.3	8.3	8.4	0.2	0.4%
R4	10.3	7.5	7.6	0.1	0.2%
R5	14.1	8.6	8.7	0.1	0.3%
R6	14.0	8.6	8.7	0.1	0.2%
R7	9.0	7.2	7.2	<0.1	0.1%
R13	11.3	7.7	7.7	<0.1	0.1%
R14	17.7	9.4	9.5	0.1	0.1%
R15	19.5	10.2	10.3	0.1	0.2%
R16	8.5	7.0	7.0	<0.1	<0.1%
R17	15.4	8.9	8.9	<0.1	<0.1%
R19	8.5	7.0	7.1	0.1	0.2%
R22	17.2	9.5	9.6	0.1	0.2%
R23	19.5	10.2	10.3	0.1	0.2%
R24	9.9	7.4	7.5	<0.1	0.1%
R34	15.6	9.0	9.1	0.1	0.2%

Receptor ID	2023 Baseline (µg/m^3)	2034 Baseline (µg/m^3)	2034 Construction Scenario (µg/m^3)	Change in NO_2 Concentration (2034 Baseline – 2034 Scenario) (µg/m^3)	Change as % of AQAL (%)
R35	7.6	6.8	6.8	<0.1	<0.1%
R36	18.7	10.0	10.1	0.1	0.2%
R37	13.8	8.7	8.7	<0.1	<0.1%
R38	10.3	7.6	7.6	<0.1	<0.1%
R39	11.1	7.9	7.9	<0.1	<0.1%
R40	7.0	6.6	6.6	<0.1	<0.1%
R42	6.6	6.5	6.5	<0.1	<0.1%

Table 12: Predicted change in annual mean NO_2 concentrations at discrete receptors due to construction road traffic and maintenance vehicle emissions, with comparison against AQAL

Receptor ID	2023 Baseline (µg/m^3)	2034 Baseline (µg/m^3)	2034 Construction + Maintenance Scenario (µg/m^3)	Change in NO_2 Concentration (2034 Baseline – 2034 Scenario) (µg/m^3)	Change as % of AQAL (%)
R1	10.1	7.6	8.4	0.8	2.0%
R2	12.3	8.3	8.5	0.2	0.5%
R4	10.3	7.5	7.6	0.1	0.2%

Receptor ID	2023 Baseline (µg/m³)	2034 Baseline (µg/m³)	2034 Construction + Maintenance Scenario (µg/m³)	Change in NO_2 Concentration (2034 Baseline – 2034 Scenario) (µg/m³)	Change as % of AQAL (%)
R5	14.1	8.6	8.7	0.1	0.4%
R6	14.0	8.6	8.7	0.1	0.3%
R7	9.0	7.2	7.2	<0.1	0.1%
R13	11.3	7.7	7.7	<0.1	0.1%
R14	17.7	9.4	9.5	0.1	0.2%
R15	19.5	10.2	10.3	0.1	0.3%
R16	8.5	7.0	7.1	<0.1	<0.1%
R17	15.4	8.9	8.9	<0.1	<0.1%
R19	8.5	7.0	7.2	0.1	0.3%
R22	17.2	9.5	9.6	0.1	0.3%
R23	19.5	10.2	10.3	0.1	0.3%
R24	9.9	7.4	7.5	<0.1	0.1%
R34	15.6	9.0	9.1	0.1	0.2%
R35	7.6	6.8	6.8	<0.1	<0.1%
R36	18.7	10.0	10.1	0.1	0.3%
R37	13.8	8.7	8.7	<0.1	<0.1%
R38	10.3	7.6	7.6	<0.1	<0.1%

Receptor ID	2023 Baseline (µg/m³)	2034 Baseline (µg/m³)	2034 Construction + Maintenance Scenario (µg/m³)	Change in NO_2 Concentration (2034 Baseline – 2034 Scenario) (µg/m³)	Change as % of AQAL (%)
R39	11.1	7.9	7.9	<0.1	<0.1%
R40	7.0	6.6	6.6	<0.1	<0.1%
R42	6.6	6.5	6.5	<0.1	<0.1%

1.3.55 Change in annual mean PM_{10} and $PM_{2.5}$ concentrations at discrete receptors that would occur from the road traffic associated with the construction of the Proposed Development, at the selected sensitive receptors, is presented in **Table 13** and **Table 15** for the main construction scenario, and **Table 14** and **Table 16** for the construction sensitivity scenario. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

1.3.56 In the main construction scenario, the maximum predicted change in annual mean PM_{10} and $PM_{2.5}$ concentrations at the selected sensitive receptors is 0.5 $\mu g/m^3$ and 0.3 $\mu g/m^3$ respectively, recorded at R1 on Kelsterton Road. This change in annual mean PM_{10} and $PM_{2.5}$ concentrations would not result in additional days on which the PM_{10} 24-hour objective is exceeded.

1.3.57 In the construction sensitivity scenario, the maximum predicted change in annual mean PM_{10} and $PM_{2.5}$ concentrations at the selected sensitive receptors is 0.7 $\mu g/m^3$ and 0.4 $\mu g/m^3$ respectively, recorded at R1 on Kelsterton Road. This change in annual mean PM_{10} and $PM_{2.5}$ concentrations would not result in additional days on which the PM_{10} 24-hour objective is exceeded.

1.3.58 The predicted annual mean concentrations are well below the respective AQAL for PM_{10} and $PM_{2.5}$ for both scenarios.

Table 13: Predicted change in annual mean PM_{10} concentrations at discrete receptors due to construction road traffic emissions, with comparison against AQAL

Receptor ID	2023 Baseline (µg/m^3)	2034 Baseline (µg/m^3)	2034 Construction Scenario (µg/m^3)	Change in PM_{10} Concentration (2034 Baseline – 2034 Scenario) (µg/m^3)	Change as % of AQAL (%)
R1	10.4	9.6	10.2	0.5	1.4%
R2	10.8	10.0	10.1	0.1	0.3%
R4	11.0	10.1	10.2	0.1	0.1%
R5	12.0	10.9	11.0	0.1	0.2%
R6	11.9	10.9	11.0	0.1	0.2%
R7	11.1	10.2	10.2	<0.1	0.1%
R13	11.4	10.5	10.5	<0.1	0.1%
R14	13.3	12.1	12.2	0.1	0.2%
R15	14.1	12.7	12.8	0.1	0.3%
R16	11.0	10.1	10.1	<0.1	<0.1%
R17	12.8	11.6	11.6	<0.1	<0.1%
R19	10.4	9.6	9.7	0.1	0.3%
R22	13.4	12.2	12.3	0.1	0.3%
R23	14.1	12.7	12.8	0.1	0.3%
R24	11.8	10.8	10.8	<0.1	0.1%
R34	13.4	12.1	12.2	0.1	0.2%

Receptor ID	2023 Baseline ($\mu g/m^3$)	2034 Baseline ($\mu g/m^3$)	2034 Construction Scenario ($\mu g/m^3$)	Change in PM_{10} Concentration (2034 Baseline – 2034 Scenario) ($\mu g/m^3$)	Change as % of AQAL (%)
R35	11.2	10.3	10.3	<0.1	<0.1%
R36	14.3	12.8	12.9	0.1	0.2%
R37	12.8	11.5	11.5	<0.1	<0.1%
R38	11.5	10.5	10.5	<0.1	<0.1%
R39	11.9	10.8	10.8	<0.1	<0.1%
R40	11.4	10.4	10.4	<0.1	<0.1%
R42	10.5	9.7	9.7	<0.1	<0.1%

Table 14: Predicted change in annual mean PM_{10} concentrations at discrete receptors due to construction road traffic and maintenance vehicle emissions, with comparison against AQAL

Receptor ID	2023 Baseline ($\mu g/m^3$)	2034 Baseline ($\mu g/m^3$)	2034 Construction + Maintenance Scenario ($\mu g/m^3$)	Change in PM_{10} Concentration (2034 Baseline – 2034 Scenario) ($\mu g/m^3$)	Change as % of AQAL (%)
R1	10.4	9.6	10.3	0.7	1.7%
R2	10.8	10.0	10.1	0.1	0.3%
R4	11.0	10.1	10.2	0.1	0.2%
R5	12.0	10.9	11.1	0.1	0.3%

Receptor ID	2023 Baseline ($\mu g/m^3$)	2034 Baseline ($\mu g/m^3$)	2034 Construction + Maintenance Scenario ($\mu g/m^3$)	Change in PM_{10} Concentration (2034 Baseline – 2034 Scenario) ($\mu g/m^3$)	Change as % of AQAL (%)
R6	11.9	10.9	11.0	0.1	0.3%
R7	11.1	10.2	10.3	<0.1	0.1%
R13	11.4	10.5	10.5	<0.1	0.1%
R14	13.3	12.1	12.2	0.1	0.2%
R15	14.1	12.7	12.9	0.2	0.4%
R16	11.0	10.1	10.1	<0.1	<0.1%
R17	12.8	11.6	11.6	<0.1	<0.1%
R19	10.4	9.6	9.7	0.1	0.3%
R22	13.4	12.2	12.3	0.1	0.4%
R23	14.1	12.7	12.9	0.2	0.4%
R24	11.8	10.8	10.8	<0.1	0.1%
R34	13.4	12.1	12.2	0.1	0.3%
R35	11.2	10.3	10.3	<0.1	<0.1%
R36	14.3	12.8	13.0	0.1	0.3%
R37	12.8	11.5	11.6	<0.1	<0.1%
R38	11.5	10.5	10.5	<0.1	<0.1%
R39	11.9	10.8	10.8	<0.1	<0.1%

Receptor ID	2023 Baseline (µg/m³)	2034 Baseline (µg/m³)	2034 Construction + Maintenance Scenario (µg/m³)	Change in PM_{10} Concentration (2034 Baseline – 2034 Scenario) (µg/m³)	Change as % of AQAL (%)
R40	11.4	10.4	10.4	<0.1	<0.1%
R42	10.5	9.7	9.7	<0.1	<0.1%

Table 15: Predicted change in annual mean $PM_{2.5}$ concentrations at discrete receptors due to construction road traffic emissions, with comparison against AQAL

Receptor ID	2023 Baseline (µg/m³)	2034 Baseline (µg/m³)	2034 Construction Scenario (µg/m³)	Change in $PM_{2.5}$ Concentration (2034 Baseline – 2034 Scenario) (µg/m³)	Change as % of AQAL (µg/m³)
R1	6.1	5.4	5.7	0.3	1.2%
R2	6.3	5.6	5.7	0.1	0.2%
R4	6.3	5.5	5.5	<0.1	0.1%
R5	6.8	5.9	6.0	0.1	0.2%
R6	6.8	5.9	6.0	<0.1	0.2%
R7	6.6	5.8	5.8	<0.1	0.1%
R13	6.4	5.6	5.6	<0.1	0.1%
R14	7.4	6.4	6.5	<0.1	0.2%
R15	8.2	7.1	7.1	0.1	0.3%

Receptor ID	2023 Baseline (µg/m^3)	2034 Baseline (µg/m^3)	2034 Construction Scenario (µg/m^3)	Change in $PM_{2.5}$ Concentration (2034 Baseline – 2034 Scenario) (µg/m^3)	Change as % of AQAL (µg/m^3)
R16	6.5	5.7	5.7	<0.1	<0.1%
R17	7.5	6.5	6.5	<0.1	<0.1%
R19	6.0	5.2	5.3	0.1	0.2%
R22	7.8	6.8	6.8	0.1	0.2%
R23	8.2	7.1	7.1	0.1	0.3%
R24	7.3	6.3	6.4	<0.1	0.1%
R34	8.2	7.0	7.1	<0.1	0.2%
R35	7.0	6.1	6.1	<0.1	<0.1%
R36	8.6	7.4	7.5	0.1	0.2%
R37	7.8	6.7	6.8	<0.1	<0.1%
R38	6.9	6.1	6.1	<0.1	<0.1%
R39	7.1	6.2	6.2	<0.1	<0.1%
R40	7.1	6.2	6.2	<0.1	<0.1%
R42	6.4	5.7	5.7	<0.1	<0.1%

Table 16: Predicted change in annual mean $PM_{2.5}$ concentrations at discrete receptors due to construction road traffic and maintenance vehicle emissions, with comparison against AQAL

Receptor ID	2023 Baseline ($\mu g/m^3$)	2034 Baseline ($\mu g/m^3$)	2034 Construction + Maintenance Scenario ($\mu g/m^3$)	Change in $PM_{2.5}$ Concentration (2034 Baseline – 2034 Scenario) ($\mu g/m^3$)	Change as % of AQAL ($\mu g/m^3$)
R1	6.1	5.4	5.7	0.4	1.4%
R2	6.3	5.6	5.7	0.1	0.3%
R4	6.3	5.5	5.5	<0.1	0.2%
R5	6.8	5.9	6.0	0.1	0.3%
R6	6.8	5.9	6.0	0.1	0.2%
R7	6.6	5.8	5.8	<0.1	0.1%
R13	6.4	5.6	5.6	<0.1	0.1%
R14	7.4	6.4	6.5	0.1	0.2%
R15	8.2	7.1	7.2	0.1	0.4%
R16	6.5	5.7	5.7	<0.1	<0.1%
R17	7.5	6.5	6.5	<0.1	<0.1%
R19	6.0	5.2	5.3	0.1	0.3%
R22	7.8	6.8	6.9	0.1	0.3%
R23	8.2	7.1	7.2	0.1	0.4%
R24	7.3	6.3	6.4	<0.1	0.1%
R34	8.2	7.0	7.1	0.1	0.2%

Receptor ID	2023 Baseline (µg/m³)	2034 Baseline (µg/m³)	2034 Construction + Maintenance Scenario (µg/m³)	Change in $PM_{2.5}$ Concentration (2034 Baseline – 2034 Scenario) (µg/m³)	Change as % of AQAL (µg/m³)
R35	7.0	6.1	6.1	<0.1	<0.1%
R36	8.6	7.4	7.5	0.1	0.3%
R37	7.8	6.7	6.8	<0.1	<0.1%
R38	6.9	6.1	6.1	<0.1	<0.1%
R39	7.1	6.2	6.2	<0.1	<0.1%
R40	7.1	6.2	6.2	<0.1	<0.1%
R42	6.4	5.7	5.7	<0.1	<0.1%

1.3.59 In summary, as the maximum change as % of AQAL (µg/m^3) is 1.7%, the predicted results for human health are not significant. This is further discussed in **Chapter 8: Air Quality** (**EN010166/APP/6.2.8**). **Table 17**, **Table 19**, ~~and~~ **Table 21** and **Table 23** display the relevant information and assessment results for the designated ecological sites in the main construction scenario.

1.3.60 The predicted concentrations are at 1% or less than the relevant AQAL for NOx, which means impacts can be screened out as insignificant without further assessment at all receptors.

1.3.61 For NH_3 and nitrogen deposition, impacts exceed 1% of the relevant AQAL at some receptors, although they are all below 100% of the AQAL. As the receptors where predicted impacts are predicted to be above 1% of the AQAL but below 100% are Non-statutory designated sites except TE8, impacts can be screened out as well.

1.3.62 For acid deposition, impacts exceed 1% of the relevant AQAL at some receptors, although they are all below 100% of the AQAL. As the receptors where predicted impacts are predicted to be above 1% of the AQAL but below 100% are Non-statutory designated sites, impacts can be screened out.

~~1.3.61~~

~~1.3.62~~1.3.63 **Table 18**, **Table 20**: ~~and~~ , **Table 22**: and **Table 24** display the relevant information and assessment results for the designated ecological sites in the construction sensitivity scenario.

~~1.3.63~~1.3.64 The predicted concentrations are at 1% or less than the relevant AQAL for NOx, which means impacts can be screened out as insignificant without further assessment at all receptors.

~~1.3.64~~1.3.65 For NH_3 ~~and~~ , nitrogen deposition and acid deposition, impacts exceed 1% of the relevant AQAL at some receptors, although they are all below 100% of the AQAL. As the receptors where predicted impacts are predicted to be above 1% of the AQAL but below 100% are Non-statutory designated sites except TE8, impacts can be screened out as well.

~~This is discussed further in, **Chapter 8: Air Quality** (**EN010166/APP/6.2.8**).~~

Table 17: Dispersion modelling results for ecological receptors from construction traffic emissions – NOx Annual Mean (µg/m^3)

Receptor ID	Critical Level	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in NOx Concentration (2034 Baseline – 2034 Scenario)	Change in NOx Concentration as a % of Critical Level
TE1	30	11.0	10.0	1<0.1	<0.1	<0.1%
TE2	30	6.6	6.5	6.5	<0.1	<0.1%
TE3	30	13.9	9.0	9.0	<0.1	<0.1%
TE4	30	11.2	8.3	8.5	0.2	0.7%
TE5	30	11.3	8.6	8.8	0.2	0.7%
TE6	30	11.3	8.6	8.8	0.2	0.7%
TE7a	30	20.4	12.6	12.6	<0.1	<0.1%
TE7b	30	10.1	9.1	9.1	<0.1	<0.1%
TE7c	30	10.1	9.1	9.1	<0.1	<0.1%
TE8a	30	14.2	10.9	10.9	<0.1	0.1%
TE8b	30	25.9	14.0	14.5	0.5	1.6%
TE8c	30	15.8	13.1	13.2	<0.1	0.1%

Table 18 Dispersion modelling results for ecological receptors from construction traffic and maintenance vehicle emissions – NOx Annual Mean (µg/m^3)

Receptor ID	Critical Level	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in NOx Concentration (2034 Baseline – 2034 Scenario)	Change in NOx Concentration as a % of Critical Level
TE1	30	11.0	10.0	1<0.1	<0.1	0.1%
TE2	30	6.6	6.5	6.5	<0.1	<0.1%
TE3	30	13.9	9.0	9.0	<0.1	<0.1%
TE4	30	11.2	8.3	8.6	0.3	0.9%
TE5	30	11.3	8.6	8.9	0.3	1.0%
TE6	30	11.3	8.6	8.9	0.3	1.0%
TE7a	30	20.4	12.6	12.6	<0.1	<0.1%
TE7b	30	10.1	9.1	9.1	<0.1	<0.1%
TE7c	30	10.1	9.1	9.1	<0.1	<0.1%
TE8a	30	14.2	10.9	10.9	<0.1	0.1%
TE8b	30	25.9	14.0	14.5	0.5	1.7%
TE8c	30	15.8	13.1	13.2	<0.1	0.2%

Table 19: Dispersion modelling results for ecological receptors from construction traffic emissions – NH_3 Annual Mean (µg/m^3)

Receptor ID	Critical Level	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in NH_3 Concentration (2034 Baseline – 2034 Scenario)	Change in NH_3 Concentration as a % of Critical Level
TE1	1	1.7	1.7	1.7	<0.1	0.4%
TE2	1	1.4	1.4	1.4	<0.1	<0.1%
TE3	1	2.2	2.2	2.2	<0.1	0.2%
TE4	1	2.0	2.0	2.1	0.1	7.5%
TE5	1	2.0	2.0	2.0	0.1	7.9%
TE6	1	2.0	2.0	2.0	0.1	8.0%
TE7a	1	2.7	2.7	2.7	<0.1	0.1%
TE7b	1	2.0	2.0	2.0	<0.1	0.1%
TE7c	1	2.0	2.0	2.0	<0.1	0.2%
TE8a	1	1.9	1.9	1.9	<0.1	1.1%
TE8b	1	3.2	3.2	3.4	0.1	12.4%
TE8c	1	2.2	2.2	2.2	<0.1	1.5%

Table 20: Dispersion modelling results for ecological receptors from construction traffic and maintenance vehicle emissions – NH_3 Annual Mean (µg/m³)

Receptor ID	Critical Level	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in NH_3 Concentration (2034 Baseline – 2034 Scenario)	Change in NH_3 Concentration as a % of Critical Level
TE1	1	1.7	1.7	1.7	<0.1	0.5%
TE2	1	1.4	1.4	1.4	<0.1	0.1%
TE3	1	2.2	2.2	2.2	<0.1	0.3%
TE4	1	2.0	2.0	2.1	0.1	10.2%
TE5	1	2.0	2.0	2.1	0.1	10.7%
TE6	1	2.0	2.0	2.1	0.1	10.9%
TE7a	1	2.7	2.7	2.7	<0.1	0.2%
TE7b	1	2.0	2.0	2.0	<0.1	0.2%
TE7c	1	2.0	2.0	2.0	<0.1	0.2%
TE8a	1	1.9	1.9	1.9	<0.1	1.5%
TE8b	1	3.2	3.2	3.4	0.1	13.3%
TE8c	1	2.2	2.2	2.2	<0.1	2.0%

Table 21: Dispersion modelling results for ecological receptors from construction traffic – nutrient nitrogen deposition (kgN/ha/yr)

Receptor ID	Critical Load	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in Nitrogen Deposition (2034 Baseline – 2034 Scenario)	Change in Nitrogen Deposition as a % of Critical Load
TE1	10	29.3	28.1	28.1	<0.1	0.3%
TE2	10	28.8	27.7	27.7	<0.1	<0.1%
TE3	10	34.6	32.7	32.8	<0.1	0.2%
TE4	10	32.7	31.2	31.8	0.6	6.1%
TE5	10	31.9	30.4	31.1	0.6	6.5%
TE6	10	31.9	30.4	31.1	0.7	6.6%
TE7a	10	39.3	36.9	36.9	<0.1	0.1%
TE7b	10	31.7	30.5	30.5	<0.1	0.1%
TE7c	10	31.8	30.5	30.5	<0.1	0.1%
TE8a	5	18.2	16.8	16.9	0.1	1.2%
TE8b	5	25.1	23.4	24.1	0.7	13.5%
TE8c	5	18.7	17.4	17.5	0.1	1.6%

Table 22: Dispersion modelling results for ecological receptors from construction traffic and maintenance vehicles– nutrient nitrogen deposition (kgN/ha/yr)

Receptor ID	Critical Load	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in Nitrogen Deposition (2034 Baseline – 2034 Scenario)	Change in Nitrogen Deposition as a % of Critical Load
TE1	10	29.3	28.1	28.3	0.2	1.8%
TE2	10	28.8	27.7	27.9	0.1	1.4%
TE3	10	34.6	32.7	32.9	0.2	1.7%
TE4	10	32.7	31.2	32.2	1.0	9.7%
TE5	10	31.9	30.4	31.4	1.0	10.2%
TE6	10	31.9	30.4	31.5	1.0	10.3%
TE7a	10	39.3	36.9	37.0	0.2	1.6%
TE7b	10	31.7	30.5	30.7	0.2	1.5%
TE7c	10	31.8	30.5	30.7	0.2	1.6%
TE8a	5	18.2	16.8	17.1	0.2	4.4%
TE8b	5	25.1	23.4	24.2	0.9	17.4%
TE8c	5	18.7	17.4	17.6	0.2	5.0%

Table 23: Dispersion modelling results for ecological receptors from construction traffic – acid deposition (kgeq/ha/yr)

Receptor ID	Critical Load	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in Nitrogen Deposition (2034 Baseline – 2034 Scenario)	Change in Nitrogen Deposition as a % of Critical Load
TE1	1.782	2.09	2.01	2.01	<0.01	0.1%
TE2	1.705	2.06	1.98	1.98	<0.01	<0.1%
TE3	1.811	2.47	2.34	2.34	<0.01	0.1%
TE4	1.811	2.34	2.23	2.27	0.04	2.4%
TE5	1.781	2.28	2.17	2.22	0.05	2.6%
TE6	1.781	2.28	2.17	2.22	0.05	2.6%
TE7a	1.72	2.81	2.63	2.63	<0.01	0.1%
TE7b	1.72	2.27	2.18	2.18	<0.01	<0.1%
TE7c	1.72	2.27	2.18	2.18	<0.01	0.1%
TE8a	1.574	1.30	1.20	1.21	<0.01	0.3%
TE8b	4.824	1.79	1.67	1.72	0.05	1.0%
TE8c	4.824	1.33	1.24	1.25	0.01	0.1%

Table 24: Dispersion modelling results for ecological receptors from construction traffic and maintenance vehicles – acid deposition (kgeq/ha/yr)

Receptor ID	Critical Load	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in Nitrogen Deposition (2034 Baseline – 2034 Scenario)	Change in Nitrogen Deposition as a % of Critical Load
TE1	1.782	2.09	2.01	2.02	0.01	0.7%
TE2	1.705	2.06	1.98	1.99	0.01	0.6%
TE3	1.811	2.47	2.34	2.35	0.01	0.7%
TE4	1.811	2.34	2.23	2.30	0.07	3.8%
TE5	1.781	2.28	2.17	2.25	0.07	4.1%
TE6	1.781	2.28	2.17	2.25	0.07	4.1%
TE7a	1.72	2.81	2.63	2.64	0.01	0.7%
TE7b	1.72	2.27	2.18	2.19	0.01	0.6%
TE7c	1.72	2.27	2.18	2.19	0.01	0.6%
TE8a	1.574	1.30	1.20	1.22	0.02	1.0%
TE8b	4.824	1.79	1.67	1.73	0.06	1.3%
TE8c	4.824	1.33	1.24	1.26	0.02	0.4%

1.3.66 It is considered that the assessment of construction traffic impacts carried out would be comparable with, or more than, the likely impacts associated with traffic impacts of the Proposed Development decommissioning activities. On this basis a separate assessment of decommissioning activities is not provided.

Results of the Operational Traffic Assessment

1.3.67 The predicted change in pollutant concentrations that are predicted to occur due to traffic associated with Proposed Development operation at the selected sensitive receptors, are presented and discussed in **Appendix 8-D: Air Quality Operational Assessment** (**EN010166/APP/6.4**). Predicted concentrations are receptors sensitive to traffic and stack emissions have been combined to assess to overall impact of the Proposed Development. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

1.4 Conclusions

1.4.1 The emissions from changes in construction traffic flows are largely imperceptible (less than 0.5% of the air quality assessment level), with low impact predicted at a limited number of receptors (less than 2% of the air quality assessment level) for all air pollutants at all human receptor locations.

1.4.2 The corresponding changes receptors that are representative of designated ecosystems can be screened out at Non-statutory designated sites but would need to be assessed further for nationally designated sites.

1.4.3 It is considered that the likely traffic impacts associated with the Proposed Development decommissioning would be comparable with, or less than, the Proposed Development construction traffic impacts.

1.4.4 Conclusions on significance are presented in **Chapter 8: Air Quality** (**EN010166/APP/6.2.8**).

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Ref 6. Centre for Ecology and Hydrology and APIS (2017). Air Pollution Information System.

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Ref 9. Laxen, D and Marner, B. (2003). Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites.

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Annex A

In Combination Assessment results – Ecological Receptors

The in-combination assessment results below have been considered in the **Report to Inform Habitats Regulations Assessment** (**EN010166/APP/6.12**) submitted with the Application.

Table A-1: Dispersion modelling results for ecological receptors from construction traffic emissions – NOx Annual Mean (µg/m³)

Receptor ID	Critical Level	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in NOx Concentration (2034 Baseline – 2034 Scenario)	Change in NOx Concentration as a % of Critical Level
TE1	30	11.0	10.0	10.0	<0.1	0.1%
TE2	30	6.6	6.5	6.5	<0.1	<0.1%
TE3	30	13.9	8.8	9.0	0.2	0.6%
TE4	30	11.2	8.2	8.5	0.3	1.0%
TE5	30	11.3	8.5	8.8	0.3	1.0%
TE6	30	11.3	8.5	8.8	0.3	1.0%
TE7a	30	20.4	12.3	12.6	0.3	1.1%
TE7b	30	10.1	9.0	9.1	<0.1	0.2%
TE7c	30	10.1	9.0	9.1	<0.1	0.2%
TE8a	30	14.2	10.8	10.9	0.1	0.4%
TE8b	30	25.9	13.6	14.3	0.7	2.2%
TE8c	30	15.8	13.0	13.2	0.1	0.4%

Table A-2: Dispersion modelling results for ecological receptors from construction traffic and maintenance vehicle emissions – NOx Annual Mean (µg/m³)

Receptor ID	Critical Level	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in NOx Concentration (2034 Baseline – 2034 Scenario)	Change in NOx Concentration as a % of Critical Level
TE1	30	11.0	10.0	10.0	<0.1	0.2%
TE2	30	6.6	6.5	6.5	<0.1	<0.1%
TE3	30	13.9	8.8	9.0	0.2	0.6%
TE4	30	11.2	8.2	8.6	0.3	1.1%
TE5	30	11.3	8.5	8.9	0.3	1.1%
TE6	30	11.3	8.5	8.9	0.4	1.2%
TE7a	30	20.4	12.3	12.6	0.3	1.1%
TE7b	30	10.1	9.0	9.1	<0.1	0.2%
TE7c	30	10.1	9.0	9.1	<0.1	0.2%
TE8a	30	14.2	10.8	10.9	0.1	0.5%
TE8b	30	25.9	13.6	14.3	0.7	2.3%
TE8c	30	15.8	13.0	13.2	0.1	0.5%

Table A-3: Dispersion modelling results for ecological receptors from construction traffic emissions – NH_3 Annual Mean (µg/m^3)

Receptor ID	Critical Level	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in NH_3 Concentration (2034 Baseline – 2034 Scenario)	Change in NH_3 Concentration as a % of Critical Level
TE1	1	1.7	1.6	1.7	<0.1	1.3%
TE2	1	1.4	1.4	1.4	<0.1	0.1%
TE3	1	2.2	2.2	2.2	0.1	5.0%
TE4	1	2.0	2.0	2.1	0.1	10.2%
TE5	1	2.0	1.9	2.0	0.1	10.4%
TE6	1	2.0	1.9	2.0	0.1	10.5%
TE7a	1	2.7	2.6	2.7	0.1	7.5%
TE7b	1	2.0	1.9	2.0	<0.1	1.1%
TE7c	1	2.0	1.9	2.0	<0.1	1.2%
TE8a	1	1.9	1.9	1.9	<0.1	3.8%
TE8b	1	3.2	3.1	3.3	0.2	18.4%
TE8c	1	2.2	2.2	2.2	<0.1	4.0%

Table A-4: Dispersion modelling results for ecological receptors from construction traffic and maintenance vehicle emissions – NH_3 Annual Mean (µg/m³)

Receptor ID	Critical Level	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in NH_3 Concentration (2034 Baseline – 2034 Scenario)	Change in NH_3 Concentration as a % of Critical Level
TE1	1	1.7	1.6	1.7	<0.1	1.3%
TE2	1	1.4	1.4	1.4	<0.1	0.1%
TE3	1	2.2	2.2	2.2	0.1	5.1%
TE4	1	2.0	2.0	2.1	0.1	11.5%
TE5	1	2.0	1.9	2.1	0.1	11.8%
TE6	1	2.0	1.9	2.1	0.1	11.9%
TE7a	1	2.7	2.6	2.7	0.1	7.5%
TE7b	1	2.0	1.9	2.0	<0.1	1.1%
TE7c	1	2.0	1.9	2.0	<0.1	1.2%
TE8a	1	1.9	1.9	1.9	<0.1	4.0%
TE8b	1	3.2	3.1	3.3	0.2	18.9%
TE8c	1	2.2	2.2	2.2	<0.1	4.3%

Table A-5: Dispersion modelling results for ecological receptors from construction traffic – nutrient nitrogen deposition (kgN/ha/yr)

Receptor ID	Critical Load	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in Nitrogen Deposition (2034 Baseline – 2034 Scenario)	Change in Nitrogen Deposition as a % of Critical Load
TE1	10	29.3	28.0	28.1	0.1	1.0%
TE2	10	28.8	27.7	27.7	<0.1	0.1%
TE3	10	34.6	32.3	32.8	0.4	4.2%
TE4	10	32.7	31.0	31.8	0.8	8.4%
TE5	10	31.9	30.2	31.1	0.9	8.5%
TE6	10	31.9	30.2	31.1	0.9	8.7%
TE7a	10	39.3	36.2	36.9	0.6	6.4%
TE7b	10	31.7	30.4	30.5	0.1	0.9%
TE7c	10	31.8	30.4	30.5	0.1	1.0%
TE8a	5	18.2	16.7	16.9	0.2	4.1%
TE8b	5	25.1	22.7	23.7	1.0	20.1%
TE8c	5	18.7	17.3	17.5	0.2	4.4%

Table A-6: Dispersion modelling results for ecological receptors from construction traffic and maintenance vehicles– nutrient nitrogen deposition (kgN/ha/yr)

Receptor ID	Critical Load	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in Nitrogen Deposition (2034 Baseline – 2034 Scenario)	Change in Nitrogen Deposition as a % of Critical Load
TE1	10	29.3	28.0	28.2	0.2	2.5%
TE2	10	28.8	27.7	27.9	0.2	1.5%
TE3	10	34.6	32.3	32.9	0.6	5.6%
TE4	10	32.7	31.0	32.1	1.1	10.9%
TE5	10	31.9	30.2	31.3	1.1	11.1%
TE6	10	31.9	30.2	31.3	1.1	11.2%
TE7a	10	39.3	36.2	37.0	0.8	7.8%
TE7b	10	31.7	30.4	30.7	0.2	2.3%
TE7c	10	31.8	30.4	30.7	0.2	2.4%
TE8a	5	18.2	16.7	17.1	0.4	7.1%
TE8b	5	25.1	22.7	23.9	1.2	23.4%
TE8c	5	18.7	17.3	17.6	0.4	7.4%

Table A-7: Dispersion modelling results for ecological receptors from construction traffic – acid deposition (kgeq/ha/yr)

Receptor ID	Critical Load	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in Nitrogen Deposition (2034 Baseline – 2034 Scenario)	Change in Nitrogen Deposition as a % of Critical Load
TE1	1.782	2.09	2.00	2.01	0.01	0.4%
TE2	1.705	2.06	1.98	1.98	<0.01	<0.1%
TE3	1.811	2.47	2.31	2.34	0.03	1.7%
TE4	1.811	2.34	2.21	2.27	0.06	3.3%
TE5	1.781	2.28	2.16	2.22	0.06	3.4%
TE6	1.781	2.28	2.16	2.22	0.06	3.5%
TE7a	1.72	2.81	2.59	2.63	0.05	2.7%
TE7b	1.72	2.27	2.17	2.18	0.01	0.4%
TE7c	1.72	2.27	2.17	2.18	0.01	0.4%
TE8a	1.574	1.30	1.19	1.21	0.02	1.0%
TE8b	4.824	1.79	1.62	1.72	0.09	2.0%
TE8c	4.824	1.33	1.23	1.25	0.02	0.3%

Table A-8: Dispersion modelling results for ecological receptors from construction traffic and maintenance vehicles – acid deposition (kgeq/ha/yr)

Receptor ID	Critical Load	2023 Baseline	2034 Baseline	2034 Construction Scenario	Change in Nitrogen Deposition (2034 Baseline – 2034 Scenario)	Change in Nitrogen Deposition as a % of Critical Load
TE1	1.782	2.09	2.00	2.02	0.02	1.0%
TE2	1.705	2.06	1.98	1.99	0.01	0.6%
TE3	1.811	2.47	2.31	2.35	0.04	2.2%
TE4	1.811	2.34	2.21	2.30	0.09	4.7%
TE5	1.781	2.28	2.16	2.25	0.09	4.9%
TE6	1.781	2.28	2.16	2.25	0.09	5.0%
TE7a	1.72	2.81	2.59	2.64	0.06	3.2%
TE7b	1.72	2.27	2.17	2.19	0.02	1.0%
TE7c	1.72	2.27	2.17	2.19	0.02	1.0%
TE8a	1.574	1.30	1.19	1.22	0.03	1.7%
TE8b	4.824	1.79	1.62	1.73	0.11	2.2%
TE8c	4.824	1.33	1.23	1.26	0.03	0.6%