APPENDIX 10.1
AIR QUALITY MODELLING STUDY

Appendix 10.1: Air Quality Modelling Study

Introduction

10.1.1 This Appendix presents the technical information and data upon which the air quality assessment is based.

Construction Dust Assessment

10.1.2 **Table A1** provides examples of the potential dust emissions classes for each of the construction activities, as provided in 'The Control of Dust and Emissions during Construction and Demolition' Supplementary Planning Guidance[1] (based on the evaluation process set out in the IAQM 2014 'Guidance on the Assessment of Dust from Demolition and Construction[2]). Noted not all the criteria need to be met for a particular class. Once the class has been determined, the risk category can be determined from the matrices presented in Tables 10.4 to 10.7 in **Chapter 10: Air Quality**.

Table A1: Criteria for the Potential Dust Emissions Class

Activity	Class	Example Criteria
Demolition	Large	Total Building volume >50,000m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20m above ground level.
	Medium	Total Building volume 20,000-50,000m^3, potentially dusty construction material, demolition activities 10-20m above ground level.
	Small	Total Building volume <20,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.
Earthworks	Large	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 stockpile enclosures >8m in height, total material moved >100,000 tonnes.
	Medium	Total site area 2,500m^2 - 10,000m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of stockpile enclosures 4m-8m in height, total material moved 20,000 tonnes – 100,000 tonnes (where known).
	Small	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 stockpile enclosures <4m in height, total material moved <10,000 tonnes, earthworks during wetter months.
Construction	Large	Total Building volume >100,000m^3, piling, on site concrete batching, sand blasting.
	Medium	Total building volume 25,000 m^3 - 100,000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.
	Small	Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).
Trackout	Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay/silt content), unpaved road length >100m.
	Medium	10-50 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50-100m (high clay content).
	Small	<10 HDV (>3.5t) trips in any one day, surface material low potential for dust release, unpaved road length <50m.

10.1.3 Once the risk category has been defined, the significance of the likely dust effects can be determined, taking into account the factors that define the sensitivity of the surrounding area. Examples of the factors defining the sensitivity of the area, as set out in the IAQM guidance, are presented in Table A2.

Table A2: Examples of Factors Defining Sensitivity of the Area

Type of Effect	Sensitivity of Receptor	Examples
Sensitivities of People to Dust Soiling Effects	High	Users can reasonably expect a enjoyment of a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected[1] to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks[2] and car showrooms.
	Medium	Users would expect[1] 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 by soiling; or The people or property would not reasonably be expected[1] to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Indicative examples include parks and places of work.
	Low	The enjoyment of amenity would not reasonably be expected[1]; or Property would not reasonably be expected[1] to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks[2] and roads.
Sensitivities of People to Health Effects of PM_{10}	High	Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, relevant location would be one where individuals may be exposed for eight hours or more in a day).[3] Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.
	Medium	Locations where the people exposed are workers[4], and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.
	Low	Locations where human exposure is transient.[5] Indicative examples include public footpaths, playing fields, parks and shopping streets.

Type of Effect	Sensitivity of Receptor	Examples
Sensitivities of Receptors to Ecological Effects	High	Locations with an international or national designation and the designated features may be affected by dust soiling; or Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain[6]. Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
	Medium	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or Locations with a national designation where the features may be affected by dust deposition. Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.
	Low	Locations with a local designation where the features may be affected by dust deposition. Indicative example is a local Nature Reserve with dust sensitive features.

1 People's expectations will vary depending on the existing dust deposition in the area.

2 Car parks can have a range of sensitivities depending on the duration and frequency that people would be expected to park their cars there, and the level of amenity they could reasonably expect whilst doing so. Car parks associated with work place or residential parking might have a high level of sensitivity compared to car parks used less frequently and for shorter durations, such as those associated with shopping. Cases should be examined on their own merits.

3 This follows Defra guidance as set out in LAQM.TG(16)[3].

4 Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected to exposure of PM10. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers have been included in the medium sensitivity category.

5 There are no standards that apply to short-term exposure, e.g. one or two hours, but there is still a risk of health impacts, albeit less certain.

6 Cheffing C. M. & Farrell L. (Editors) (2005); The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee.

10.1.4 Table A3, Table A4 and Table A5 show how the sensitivity of the area may be determined for effects related to dust soiling (nuisance), human health and ecosystem respectively. Distances are to the dust source and so a different area may be affected by the on-Site works than by trackout (i.e. along the routes used to access the Site). The IAQM guidance advises that the highest level of sensitivity from each table should be recorded.

Table A3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
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

Table A4: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table A5: Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Operational Phase Air Quality Assessment

Model

10.1.5 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; which requires a range of input data, which can include pollutant emissions rates, meteorological data and local topographical information.

10.1.6 The effect of the Development on local air quality was assessed using the advanced atmospheric dispersion model ADMS-Roads and ADMS 5, taking into account the contribution of emissions from forecast road-traffic on the local road network and from the heating plant by the completion year respectively. The use of these detailed dispersion models was agreed with the air quality Environmental Health Officer (EHO) at London Borough of Richmond upon

Thames (LBRuT) during email consultation (see details at the end of this Appendix), the scoping response (see details in **Chapter 2: EIA Methodology** of the main Environmental Statement) and during a project planning meeting on the 14th November 2017.

ADMS-Roads

10.1.7 The ADMS-Roads model is a comprehensive tool for investigating air pollution in relation to road networks. On review of the Site, and its surroundings, ADMS-Roads was considered appropriate for the assessment of the long and short term effects from road traffic emissions associated with the proposals on air quality. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations. It can predict long-term and short-term concentrations, including percentile concentrations.

10.1.8 ADMS-Roads model is a formally validated model, developed in the United Kingdom (UK) by CERC (Cambridge Environmental Research Consultants). This includes comparisons with data from the UK's air quality Automatic Urban and Rural Network (AURN) and specific verification exercises using standard field, laboratory and numerical data sets. CERC is also involved in European programmes on model harmonisation, and their models were compared favourably against other EU and U.S. EPA systems. Further information in relation to this is available from the CERC website at www.cerc.co.uk.

ADMS 5

10.1.9 ADMS 5 is a Gaussian atmospheric dispersion model widely used for investigating air pollution from controlled or fugitive emissions. The model is used for a wide range of air quality assessments, from small energy centres in urban areas to large industrial facilities. It is also used to model the dispersion of odours to determine the potential for nuisance at sensitive receptors around installations. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and atmospheric stability which improve calculations of air pollutant concentrations. It can predict long-term and short-term concentrations, as well as concentration percentiles.

10.1.10 ADMS 5 is developed in the UK by CERC, and has been extensively validated against field data sets in order to assess various configurations of the model such as flat or complex terrain, line/area/volume sources, buildings, dry deposition, fluctuations and visible plumes. Further information in relation to the model validation is available from the CERC website at www.cerc.co.uk.

Model Scenarios

10.1.11 In order to assess the effect of the Development on local air quality, future 'without Development' and 'with Development' scenarios were assessed. The Development is anticipated to be complete in 2027 and therefore this is the year in which these future scenarios were modelled. The year 2016 was modelled to establish the existing baseline situation because it is the year for which available monitoring data surrounding the Site is available against which the air quality model is verified (discussed further below). Base year traffic data for 2016 and meteorological data for 2016 were also used to be consistent with the verification year.

10.1.12 Taking into account recent analyses by Defra[4] showing that historical NO_x and NO_2 concentrations are not declining in line with emission forecasts, as outlined in the main Chapter, a sensitivity analysis has been undertaken on the basis of no future reductions in NO_x

/ NO_2 concentrations (i.e. considering the potential effects of the Development against the current baseline 2016 conditions by applying the 2027 road traffic data to 2016 background concentrations and road traffic emission rates).

10.1.13 Given the size of the Development (8.6 hectares of land) and the duration of the demolition, alteration, refurbishment and construction works, detailed dispersion modelling using ADMS-Roads of the peak construction phase has been undertaken (for the year 2022) to determine the impact of exhaust emissions from construction traffic. For this modelling scenario, the above approach to the sensitivity in NO_x and NO_2 has been undertaken (i.e. considered the current baseline 2016 conditions by applying the 2022 traffic data to 2016 background concentrations and road traffic emission rates).

Traffic Data

10.1.14 Traffic flow data comprising Annual Average Daily Traffic (AADT) flows, traffic composition (% HDVs – Heavy-Duty Vehicles) and speeds (in kph) were used in the model as provided by Peter Brett Associates (PBA) for the surrounding road network. Table A6 presents the traffic data used within the air quality assessment. Table A7 presents the trips associated with the development for the air quality neutral assessment and Table A8 presents the trips associated with the peak construction phase (in 2022).

10.1.15 The methodology for calculating the expected change in vehicle trips because of the development proposals is set out in detail within the Transport Assessment and covers all of the proposed land uses. The assessment covers all traffic generated by the Site, including servicing and delivery trips.

Table A6: 24 hour AADT Data Used within the Assessment

Link Name	Speed Limit / Monitored Speed (mph)	Base 2016		Without 2027		With 2027	
		AADT	%HDV	AADT	%HDV	AADT	%HDV
A316 Clifford Avenue Northbound Flows	40	15886	10.99%	17786	10.99%	17957	10.92%
A316 Clifford Avenue Southbound Flows	40	13905	9.51%	15569	9.51%	15896	9.40%
A316 Lower Richmond Road Westbound Flows	30	17515	5.22%	19611	5.22%	19916	5.20%
A316 Lower Richmond Road Eastbound Flows	30	19226	5.68%	21526	5.68%	21812	5.66%
South Circular (north of A316) Northbound Flows	30	7777	6.10%	8708	6.10%	8804	6.08%
South Circular (north of A316) Southbound Flows	30	7086	5.60%	7933	5.60%	8077	5.58%
South Circular (south of A316) Northbound Flows	30	11075	3.91%	12400	3.91%	12400	3.91%
South Circular (south of A316) Southbound Flows	30	10089	3.60%	11297	3.60%	11393	3.60%

Link Name	Speed Limit / Monitored Speed (mph)	Base 2016		Without 2027		With 2027	
		AADT	%HDV	AADT	%HDV	AADT	%HDV
A3003 Lower Richmond Road Westbound Flows	27	8175	8.57%	9053	8.57%	9722	8.27%
A3003 Lower Richmond Road Eastbound Flows	30	8765	8.89%	9706	8.89%	10463	8.54%
Williams Lane Northbound Flows	24	8168	8.34%	9045	8.34%	9761	8.03%
Williams Lane Southbound Flows	28	8930	11.19%	9889	11.19%	10639	10.71%
Mortlake High Street Westbound Flows	26	273	6.71%	302	6.71%	678	5.29%
Mortlake High Street Eastbound Flows	26	336	7.43%	372	7.43%	705	5.95%
The Terrace (west of Barnes Bridge Station) Westbound Flows	31	8547	13.39%	9466	13.39%	9957	12.94%
The Terrace (west of Barnes Bridge Station) Eastbound Flows	21	9502	8.48%	10524	8.48%	11044	8.28%
White Hart Lane (south of Mortlake High Street) Northbound Flows	29	8293	8.66%	9184	8.66%	9572	8.48%
White Hart Lane (south of Mortlake High Street) Southbound Flows	29	8930	8.69%	9888	8.69%	10371	8.49%
Sheen Lane (north of Level Crossing) Northbound Flows	24	2168	8.27%	2401	8.27%	2503	8.10%
Sheen Lane (north of Level Crossing) Southbound Flows	26	2657	7.53%	2942	7.53%	2980	7.49%
Sheen Lane (south of Level Crossing) Northbound Flows	30	3106	4.38%	3440	4.38%	3665	4.36%
Sheen Lane (south of Level Crossing) Southbound Flows	30	2729	2.54%	3022	2.54%	3252	2.66%
Sheen Lane (south of South Circular) Northbound Flows	30	2988	1.99%	3343	1.99%	3568	2.13%
Sheen Lane (south of South Circular) Southbound Flows	30	2570	2.98%	2875	2.98%	3105	3.07%
South Circular Road (west of Sheen Lane) Westbound Flows	21	2307	3.32%	2580	3.32%	2723	3.36%

Link Name	Speed Limit / Monitored Speed (mph)	Base 2016		Without 2027		With 2027	
		AADT	%HDV	AADT	%HDV	AADT	%HDV
South Circular Road (west of Sheen Lane) Eastbound Flows	21	2510	5.07%	2808	5.07%	2941	5.03%

Table A7: 24 hour AADT Data Used within the Air Quality Neutral Assessment

Land Use	Annual Trips
Residential	1269
Education	534
Retail	240
Restaurant	173
Hotel	14
Office	235
Cinema	174
Gym	78
Community	8
Assisted Living	135

Table A8: 24 hour AADT Data Used within the Construction Vehicle Emission Assessment

Link Name	Speed Limit / Monitored Speed (mph)	Without 2022		With 2022	
		AADT	%HDV	AADT	%HDV
A316 Clifford Avenue Northbound Flows	40	17044	11.1%	17786	11.0%
A316 Clifford Avenue Southbound Flows	40	14922	9.6%	15569	9.5%
A316 Lower Richmond Road Westbound Flows	30	18780	5.3%	19611	5.2%
A316 Lower Richmond Road Eastbound Flows	30	20612	5.7%	21526	5.7%
South Circular (north of A316) Northbound Flows	30	8338	6.2%	8708	6.1%
South Circular (north of A316) Southbound Flows	30	7597	5.7%	7933	5.6%
South Circular (south of A316) Northbound Flows	30	11880	4.0%	12400	3.9%
South Circular (south of A316) Southbound Flows	30	10825	3.7%	11297	3.6%
A3003 Lower Richmond Road Westbound Flows	27	8744	9.2%	9053	8.6%
A3003 Lower Richmond Road Eastbound Flows	30	9369	9.4%	9706	8.9%
Williams Lane Northbound Flows	24	8671	8.3%	9045	8.3%
Williams Lane	28	357	7.4%	372	7.4%

Link Name	Speed Limit / Monitored Speed (mph)	Without 2022		With 2022	
		AADT	%HDV	AADT	%HDV
Southbound Flows					
Mortlake High Street Westbound Flows	26	9092	13.4%	9466	13.4%
Mortlake High Street Eastbound Flows	26	10106	8.5%	10524	8.5%
The Terrace (west of Barnes Bridge Station) Westbound Flows	31	8821	8.6%	9184	8.7%
The Terrace (west of Barnes Bridge Station) Eastbound Flows	21	9496	8.7%	9888	8.7%
White Hart Lane (south of Mortlake High Street) Northbound Flows	29	2301	8.3%	2401	8.3%
White Hart Lane (south of Mortlake High Street) Southbound Flows	29	2820	7.5%	2942	7.5%
Sheen Lane (north of Level Crossing) Northbound Flows	24	3297	4.4%	3440	4.4%
Sheen Lane (north of Level Crossing) Southbound Flows	26	2897	2.5%	3022	2.5%
Sheen Lane (south of Level Crossing) Northbound Flows	30	3200	2.0%	3343	2.0%
Sheen Lane (south of Level Crossing) Southbound Flows	30	2753	3.0%	2875	3.0%
Sheen Lane (south of South Circular) Northbound Flows	30	2470	3.3%	2580	3.3%
Sheen Lane (south of South Circular) Southbound Flows	30	2688	5.1%	2808	5.1%
South Circular Road (west of Sheen Lane) Westbound Flows	21	9851	8.9%	10272	8.7%
South Circular Road (west of Sheen Lane) Eastbound Flows	21	9514	8.2%	9920	8.1%

Vehicle Speeds

10.1.16 To consider the presence of slow moving traffic near junctions, at roundabouts, the high level of congestion at the Chalkers Corner Junction; and vehicles idling at railway level crossings the following speeds have been used:

- 10kph at road links approaching junctions, Chalkers Corner Junction and the railway level crossings on Sheen Lane and White Hart Lane;

- 5kph at the Chalkers Corner Junction and the railway level crossings on Sheen Lane and White Hart Lane; and
- at all other junction's a reduction of 10kph from the free-flowing speed.

10.1.17 Queue lengths at Chalkers Corner have been provided by PBA to replicate the existing levels of congestion on the road network and to determine when to apply the above speeds.

10.1.18 The approach to the speeds was agreed with LBRuT during the meeting of the 14th November 2017.

Diurnal Profile

10.1.19 The ADMS-Roads model uses an hourly traffic flow based on the daily (AADT) flows. Traffic flows follow a diurnal variation throughout the day and week. Therefore, a diurnal profile was used in the model to replicate how the average hourly traffic flow would vary throughout the day and the week. This was based on traffic counts undertaken in 2017 by PBA on A316 Clifford Avenue; A3003 (at the Sports Ground and Mortlake Green); Williams Lane; Mortlake High Street; The Terrace; White Hart Lane; Sheen Lane; and the South Circular. Figure A1 presents the diurnal variation in traffic flows which has been used within the model.

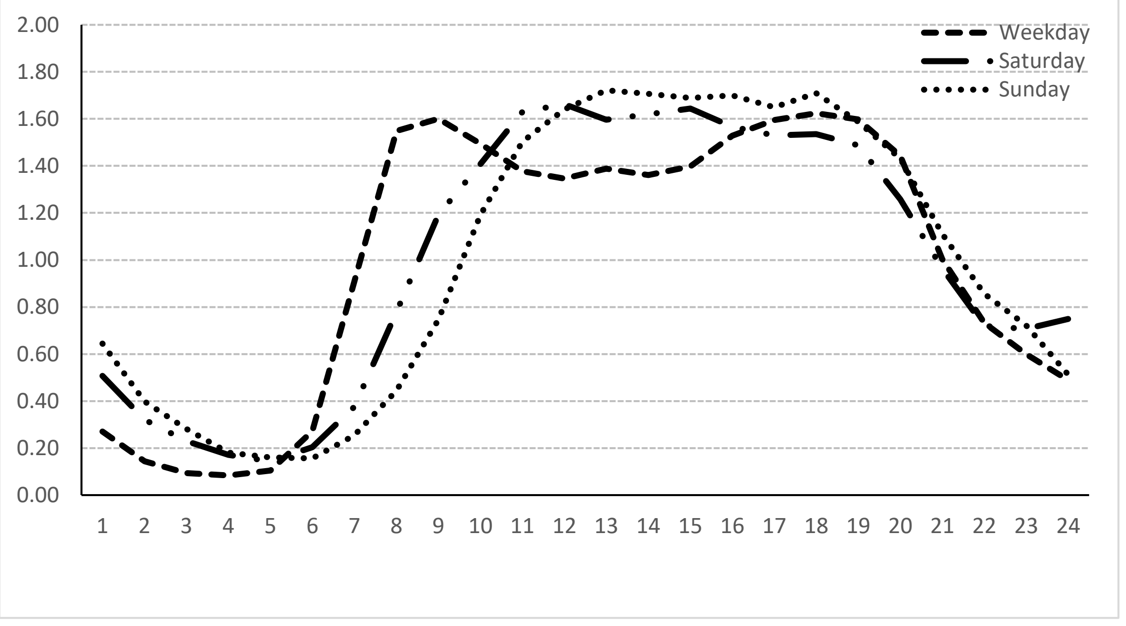

Figure A1: Local Road Network Diurnal Traffic Variation

Street Canyon Effect

10.1.20 Narrow streets with tall buildings on either side have the potential to create a confined space, which can interfere with the dispersion of traffic pollutants and may result in pollutant emissions accumulating in these streets. In an air quality model these narrow streets are described as street canyons.

10.1.21 ADMS-Roads includes a street canyon model to take account of the additional turbulent flow patterns occurring inside such a narrow street with relatively tall buildings on both sides. LAQM.TG(16) identifies a street canyon *"as narrow streets where the height of buildings on both sides of the road is greater than the road width."*

10.1.22 Following a review of the road network to be included within the model, it was considered that modelled roads are relatively wide and the existing buildings along these roads are not considered to be tall.

10.1.23 With the Development, it is considered that a street canyon, with residential exposure (contained within Buildings 13 and 17) would be created along Ship Lane. This street canyon would be created from the construction of Buildings 17, 13, 2 and 1 within the Development. A height of 21m was used in the 'with Development' scenarios to represent the proposed seven floors in Buildings 13 and 17. This is worst case as the opposite buildings are lower including the cinema in Building 1, which is only two floor levels.

10.1.24 Where receptors are located along these roads within the model domain, they have been positioned so as to be located within the street canyon (i.e. the distance from the receptor to the road centreline is less than half the canyon width).

Road Traffic Emission Factors

10.1.25 The latest version of the ADMS-Roads model (version 4.1.0) was used for the assessment. This version of the model does not include the latest vehicle emission factors published by Defra (published in November 2018). As such the latest vehicle emissions as presented in the Emission Factors Toolkit (version 8.0, as above, published in November 2017 and based on the latest COPERT database published by the European Environment Agency) have been externally calculated and added to the model.

10.1.26 The model uses several parameters (traffic flow, percentage of HDV, speed and road type) to calculate road traffic emissions for the selected pollutants.

Chalkers Corner Junction

10.1.27 Highway works are proposed at Chalkers Corner to include amendments and reconfiguration to the junction to alleviate the transport and traffic implications associated with the operation of the Development within the Stag Brewery component of the Site. The reconfiguration of the Chalkers Corner junction includes:

- the provision of a short additional left turn lane (flare) from Lower Richmond Road into the junction (26 m long or about 5 car lengths);
- provision of an extended queuing reservoir between the main junction of Lower Richmond Road (this would accommodate about 9 extra cars south westbound) and would also provide extra storage for north east bound vehicles including those waiting to turn right into Lower Richmond Road); and
- provision of a wider pedestrian island within the Lower Richmond Road arm to 4 m wide to sufficiently cater for cyclists crossing as well as pedestrians.

10.1.28 In addition, an extended, dedicated lane for traffic turning left from Clifford Avenue into Lower Richmond Road would also be provided.

10.1.29 The above reconfigurations have been included in the 'with Development' ADMS-Roads model.

10.1.30 **Appendix 10.4: Chalkers Corner Junction Interim Design Assessment** considers the impact to air quality from the changes made to the junction in isolation from the Development within the Stag Brewery component of the Site.

Car Park Extraction Strategy

10.1.31 The Development includes basement car parking with an extraction system located on Site and away from existing air quality sensitive receptors. The technical specification of the ventilation strategy is indicative at this stage and does not reflect the final system to be used. As such the basement extraction system has not been considered in the air quality assessment and the final extraction system would be designed in accordance with best practice design and appropriate regulations. This would be secured by a suitably worded planning condition. As such, it is anticipated that the car park extraction system uses within the Development would not give rise to significant environmental effects and has not been considered further at this stage.

Heating and Energy Strategy

10.1.32 The Development heating and energy strategy would provide two energy centres to serve the eastern and western parts of the Development (Application A), split by Ship Lane. In addition, a separate energy centre would be provided for the school (Application B). These are collectively referred to as the Energy Centres.

10.1.33 Technical details of indicative plant have been provided by Hoare Lea and the stack parameters used within the ADMS 5 model are presented in Table A9 below. These details do not represent the final plant to be used, however due to the number of plant proposed the air quality assessment has considered the potential impacts to determine the likely significant effect from their operation.

10.1.34 Given Table A9 does not represent the final parameters for each plant to be used once the Development is complete and operational it is considered that a suitably wording planning condition requesting an air quality assessment of the final plant would be provided by LBRuT with the granting of any planning permission.

10.1.35 To take account of the multiple point sources from the boilers and Combined Heat and Power (CHP) at each Energy Centre, ADMS 5 contains the ability to combine multiple point sources into a single stack. The stack parameters for each Energy Centre, as presented in Table A9, have been combined using the additional input file option within ADMS 5.

Table A9: Indicative Plant Stack Parameters

Energy Centre	Unit	No.	Grid Ref.	Flue Diameter (m)	Release Rate (m/s)	Release Height (m)[(a)]	Release Temp (deg ºC)	Total NO_x Emissions (g/s)[(b)(c)]
Building 02	Boiler (2400kW)	5	520430, 176018	0.70	15	35.03	70	0.1300
	CHP (560kW)	2	520430, 176018	0.15	10	35.03	150	0.0204
	CHP (610kW)	1	520430, 176018	0.18	10	35.03	150	0.0111
Building 17	Boiler (2500kW)	4	520354, 176007	0.70	15	29.30	70	0.1027
	CHP (560kW)	2	520354, 176007	0.15	10	29.30	150	0.0204
	CHP (610kW)	1	520354, 176007	0.18	10	29.30	150	0.0111
School	Boiler (750kW)	2	520216, 175982	0.35	15	20.20	70	0.0154
	CHP (226kW)	1	520216, 175982	0.10	10	20.20	150	0.0041

Note:

(a) The stack heights have been determined by the height of the Development (taking account of other factors such as visual impacts). The height of the flues has been calculated by Hoare Lea, this includes a flue of 3.7m above the roof level of Building 02; a flue of 3.3m above the roof level of Building 17; and a flue of 3m above the roof level of the School.

(b) For gas-fired plants emission factors are not provided for PM_{10} because gas-fired plants do not emit any significant level of particulates.

(c) Hoare Lea have provided an estimated seasonal profile for the energy centre, which show the boilers are used during the winter months when heating demand is high. To account of this seasonal profile, the emissions from the boilers presented in Table A1.3 have been halved following modelling as a full year. For the purposes of this assessment this approach is a reasonable assumption.

10.1.36 As shown in Table A9 above, the Development introduces three separate heating plants, located in Building 2, Building 17 and the School. Due to the limitations on the number of sources to be modelled within ADMS 5 within each model run, the heating plant assessment has modelled each Energy Centre separately. Following the model run, the predicted emissions of each heating plant have been added together to determine the total contribution.

10.1.37 The indicative plant stack parameters presented in Table A9 have been modelled in ADMS 5 across a 1km by 1km grid centred on the Development.

Building Parameters

10.1.38 Buildings can have a significant effect on the dispersion of pollutants from sources and can increase the maximum predicted ground level concentrations. ADMS 5 allows buildings to be included in to the model domain as a rectangle or as a circle.

10.1.39 The buildings module is based on experiments in which there was one dominant site building and several smaller surrounding buildings less important for dispersion.

10.1.40 For each of the Energy Centre, the building the flue is located on has been considered to be the main building. These main buildings have been considered as a rectangular building. The parameters are presented in Table A10.

Table A10: Main Building Parameters

Energy Centre	Main building	X	Y	Height (m)	Length (m)	Width (m)	Angle (deg)
Building 02	Plot 02	520430	176035	31.3	76	40	20
Building 17	Plot 17	520348	176023	26.0	57	20	0
School	School	520251	175949	17.2	100	38	0

Background Pollutant Concentrations

10.1.41 Background pollutant concentration data (i.e. concentrations due to the contribution of pollution sources not directly taken into account in the dispersion modelling) have been added to contributions from the modelled pollution sources, for each year of assessment.

10.1.42 The EHO at LBRuT has requested background pollutant concentrations monitored at the Wetlands Centre, Barnes are used within the air quality assessment. The Wetlands Centre automatic monitor is located approximately 2.5km to the north east from Site and is classified as a suburban monitor.

10.1.43 Table A11 presents the most recent monitored concentrations measured at the Wetlands Centre automatic monitor.

Table A11: Measured Concentrations at the Wetlands Centre Suburban Background Automatic Monitor

Pollutant	AQS Objective	2014	2015	2016
NO_2	Annual Mean (40µg/m^3)	25	21	25
	200ug/m^3 as a 1 hour mean, not to be exceeded more than 18 times a year	0	0	0
PM_{10}	Annual Mean (40µg/m^3)	20	22	20
	50ug/m^3 as a 24 hour mean, not to be exceeded more than 35 times a year	4	5	7

Source: LBRuT 2017 Air Quality Annual Status Report
AQS – Air Quality Strategy

10.1.44 Table A11 shows all monitored pollutants at the Wetland Centre Suburban monitor were below their respective objectives in all years.

10.1.45 In addition to the monitoring data, forecast UK background concentrations of NOx, NO2, PM10 and PM2.5 are available from the Defra LAQM Support website5 for 1x1km grid squares for assessment years between 2015 and 2030 (published in November 2017). Table A12 presents the Defra background concentrations for the year 2016, for the grid squares the Site and local receptors considered in the air quality assessment are located within.

Table A12: Defra Background Maps in 2016 for the Grid Square at the Site and the Local Area

Pollutant	Annual Mean Concentration (µg/m³)		
	520500, 176500[a]	519500, 175500[b]	520500, 175500[c]
NO_x	34.8	37.7	36.8
NO_2	23.4	25.0	24.5
PM_{10}	15.9	17.7	18.9
$PM_{2.5}$	10.3	11.3	11.9

Note: (a) Representative of Receptors: 1, 4 and Proposed Buildings 2-4, 7-9, 11, 12, 17-19, 21, 22

(b) Representative of Receptors located at Chalker's Corner and Diffusion Tube 52

(c) Representative of Receptors: Receptors 2, 3, 5-16 and Proposed Buildings 1, 5, 6. 10, 13- 16, 20 and Diffusion Tubes 21, 51, 49 and 36.

10.1.46 As shown in Table A11 and Table A12, the monitored background concentrations at the Wetlands Centre Suburban monitor in 2016 (as 25µg/m3 for annual mean NO2 and 20µg/m3 for annual mean PM10) are higher than the Defra background maps (as 24.5µg/m3 for annual mean NO2 and 18.9µg/m3 for annual mean PM10).

10.1.47 As requested by LBRuT the background concentrations from the Wetlands Centre monitor have been used within the air quality assessment, however given no data is available for PM2.5 from the automatic monitor, the Defra background maps for PM2.5 have been used. Annual mean NOx concentration for 2016 has been obtained from the London Air Quality Network6.

10.1.48 Background concentrations used in the assessment are presented in Table A13.

Table A13: Background Concentrations (µg/m³) Used within the Assessment

Pollutant	Source	2016			2027		
NO_x	LBRuT Wetlands Centre Suburban automatic monitor	43			27.5[a]		
NO_2		25			23.7[b]		
PM_{10}		20			18.3[c]		
$PM_{2.5}$	DEFRA Background Map	10.3[d]	11.3[e]	11.9[f]	9.5[d]	10.3[e]	10.9[f]

Notes:

(a) Projected factor of 0.639 used as obtained from Defra Background Maps, taken as an average from the grid squares the Site and surrounding receptors considered in the model are located within.

(b) Projected factor of 0.949 used as obtained from Defra Background Maps, taken as an average from the grid squares the Site and surrounding receptors considered in the model are located within.

(c) Projected factor of 0.914 used as obtained from Defra Background Maps, taken as an average from the grid squares the Site and surrounding receptors considered in the model are located within.

(d) Representative of Defra Background map 520500, 176500.

(e) Representative of Defra Background map 519500, 175500.

(f) Representative of Defra Background map 520500, 175500.

Meteorological Data

10.1.49 Local meteorological conditions strongly influence the dispersal of pollutants. Key meteorological data for dispersion modelling include hourly sequential data for wind direction, wind speed, temperature, precipitation and the extent of cloud cover for each hour of a given year. As a minimum ADMS-Roads and ADMS 5 requires wind speed, wind direction, and cloud cover.

10.1.50 Meteorological data to input into the model were obtained from the London Heathrow Airport Meteorological Station, which is the closest to the Site and considered to be the most representative. The 2016 data were used to be consistent with the base traffic year and model verification year. It was also used for the 2022 and 2027 scenarios for the air quality assessment. Figure A2 presents the wind-rose for the meteorological data.

10.1.51 Most dispersion models do not use meteorological data if they relate to calm winds conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75 m/s. It is recommended in LAQM.TG(16) that the meteorological data file be tested within a dispersion model and the relevant output log file checked, to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedances. LAQM.TG(16) recommends that meteorological data should only be used if the percentage of usable hours is greater than 85%. 2016 meteorological data from London Heathrow includes 8,572 lines of usable hourly data out of the total 8,784 for the year, i.e. 100% of usable data. This is above the 97.6% threshold, and is therefore adequate for the dispersion modelling.

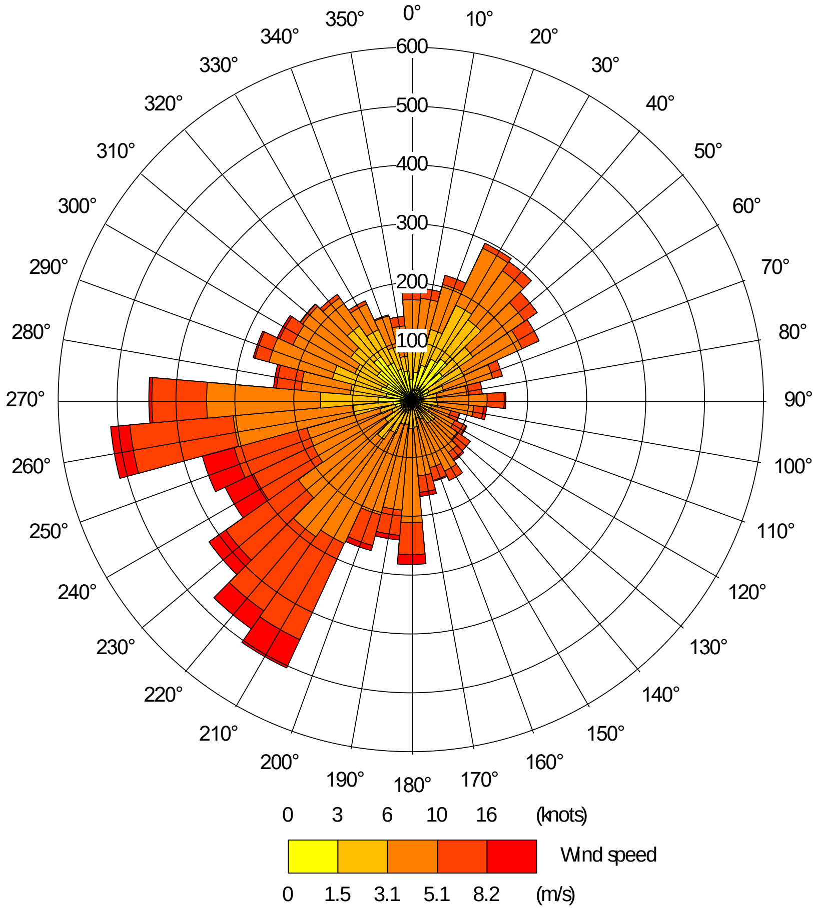

Figure A1: 2016 Wind Rose for the London Heathrow Airport Meteorological Site

10.1.52 Within the air quality models, the surface roughness of 0.2 has been used for the meteorological site, which is representative of large open areas and is considered appropriate given the immediate open surrounding area at the meteorological site.

Model Data Processing

10.1.53 The modelling results were processed to calculate the averaging periods required for comparison with the AQS objectives.

10.1.54 NOx emissions from combustion sources (including vehicle exhausts) comprise principally nitric oxide (NO) and nitrogen dioxide (NO2). The emitted nitric oxide reacts with oxidants in the air (mainly ozone (O3)) to form more NO2. Since only NO2 is associated with effects on human health, the air quality standards for the protection of human health are based on NO2 and not total NOx or NO.

10.1.55 ADMS-Roads was run without the Chemistry Reaction option to allow verification (see below). Therefore, a suitable NOX:NO2 conversion needed to be applied to the modelled NOX concentrations. There are a variety of different approaches to dealing with NOX:NO2 relationships, a number of which are widely recognised as being acceptable. However, the current approach was developed for roadside sites, and is detailed within Technical Guidance LAQM.TG(16).

10.1.56 The LAQM Support website provides a spreadsheet calculator7 to allow the calculation of NO2 from NOx concentrations, accounting for the difference between primary emissions of NOx and background NOx, the concentration of O3, and the different proportions of primary NO2 emissions, in different years. This approach is only applicable to annual mean concentrations.

10.1.57 Research8 undertaken in support of LAQM.TG(16) has indicated that the 1-hour mean AQS objective for NO2 is unlikely to be exceeded at a roadside location where the annual-mean NO2 concentration is less than 60µg/m3. The 1-hour mean objective is, therefore, not considered further within this assessment where the annual mean NO2 concentration is predicted to be less than 60µg/m3.

10.1.58 In order to calculate the number of PM10 24-hour means exceeding 50µg/m3 the relationship between the number of 24-hour mean exceedances and the annual mean PM10 concentration from LAQM.TG (09)1 was applied as follows:

$$\textbf{Number of Exceedances} = -18.5 + 0.00145 \times (\text{annual mean}^3) + \frac{206}{\text{annual mean.}}$$

10.1.59 With regards to the conversion factor for the Energy Centres, the screening approach suggested by the Environment Agency9 for continuously operating plant is to assume that for the annual mean, 70% of the NOx is converted to NO2 at ground level. This approach has been used for the NOx emissions prior to adding to the predicted annual mean NO2 concentrations.

Other Model Parameters

10.1.60 There are a number of other parameters that are used within the ADMS-Roads and ADMS 5 model which are described here for completeness and transparency:

- the model requires a surface roughness value to be inputted. A value of 1 was used at the Site (which is representative of cities and woodland) and a value of 0.2 was used at the location of the London Heathrow Airport Meteorological Station, which is representative of large open areas;

- the model requires the Monin-Obukhov length (a measure of the stability of the atmosphere) to be inputted. A value of 100m (representative of large conurbations >1,000,000) was used for the modelling; and
- the ADMS-Roads model requires the Road Type to be inputted. *'London [Outer]'* was selected and used for the modelling.

Model Verification

10.1.61 Model verification is the process of comparing monitored and modelled pollutant concentrations for the same year, at the same locations, and adjusting modelled concentrations if necessary to be consistent with monitoring data. This increases the robustness of modelling results.

10.1.62 Discrepancies between modelled and measured concentrations can arise for a number of reasons, for example:

- traffic data uncertainties;
- background concentration estimates;
- meteorological data uncertainties;
- sources not explicitly included within the model (e.g. car parks and bus stops);
- overall model limitations (e.g. treatment of roughness and meteorological data, treatment of speeds); and
- uncertainty in monitoring data, particularly diffusion tubes.

10.1.63 Verification is the process by which uncertainties such as those described above are investigated and minimised. Disparities between modelling and monitoring results are likely to arise as result of a combination of all of these aspects.

Nitrogen Dioxide

10.1.64 The dispersion model was run to predict annual mean NOx concentrations at the following LBRuT diffusion tube monitoring locations for use in the model verification:

10.1.65 Diffusion Tube 21: Lower Richmond Road, Mortlake (near Kingsway), a roadside location;

10.1.66 Diffusion Tube 51: Sheen Lane, Sheen (Railway Crossing), a kerbside location; and

10.1.67 Diffusion Tube 52: Clifford Avenue, Chalkers Corner, a kerbside location.

10.1.68 It is noted that whilst the EHO at LBRuT requested the use of Diffusion Tube 36: Upper Richmond Road West; Diffusion Tube 49: URRW War Memorial, Sheen Lane, a kerbside location; and Diffusion Tube 50: Upper Richmond Road near Clifford Avenue these monitors are located outside of the road model domain used in the air quality assessment and therefore cannot be used to check the accuracy of the model. During the meeting of the 14th November 2017 these monitors were discussed further with the EHO at LBRuT and it was agreed that only the above bulleted monitors would be considered in the model verification.

10.1.69 As highlighted above, the NO2 concentrations are a function of NOx concentrations. Therefore, the roadside NOx concentration predicted by the model was converted to NO2 using the NOx to NO2 calculator provided by Defra on the air quality archive. The background data for 2016, as presented in Table A13 were used.

10.1.70 The modelled and equivalent measured roadside NO2 concentrations at the diffusion tube sites were compared as shown in Table A14 following.

Table A14: 2014 Annual Mean NO_2 Modelled and Monitored Concentrations

Site ID	Monitored Annual Mean NO_2 ($\mu g/m^3$)	Modelled Total Annual Mean NO_2 ($\mu g/m^3$)	% Difference (modelled – monitored)
21	39	45.8	17.5
51	32	34.8	8.6
52	57	45.4	-20.4

10.1.71 Table A14 indicates that the model over predicts at Diffusion Tube 21 and Diffusion Tube 51 but under predicts at Diffusion Tube 52. Technical Guidance LAQM.TG(16) suggests that where there is disparity between modelled and monitored results, particularly if this is by more than 25%, appropriate adjustment should be undertaken. Whilst all diffusion tubes considered within the model verification are below a difference of 25% the process to adjust the model results has been undertaken to determine if the relationship between the modelling and monitoring results can be further improved.

10.1.72 LAQM.TG (16) presents a number of methods for approaching model verification and adjustment. Box 7.14 and Box 7.15 in Technical Guidance LAQM.TG(16) indicates a method based on adjusting NO2 road contribution and calculating a single adjustment factor. This method refers to modelling based on road traffic sources and can be applied to either a single diffusion tube location, or where numerous diffusion tube monitoring locations are sited within the modelled area. This requires the roadside NOx contribution to be calculated. In addition, monitored NOx concentrations are required, which were calculated from the annual mean NO2 concentration at the diffusion tube site using the NOx to NO2 spreadsheet calculator as described above. The steps involved in the adjustment process are presented in Table A15.

Table A15: Model Verification Result for Adjustment NO_x Emissions ($\mu g/m^3$)

	Monitored NO_2	Monitored NO_x	Monitored Road NO_2	Monitored Road NO_x	Modelled Road NO_x	Ratio of Monitored Road Contribution NO_x/Modelled Road Contribution NO_x
21	39	74.6	14.0	31.6	49.3	0.64
51	32	58.1	7.0	15.1	21.4	0.71
52	57	125	32.0	82.0	48.0	1.70

10.1.73 Figure A3 shows the mathematical relationship between modelled and monitored roadside NOx (i.e. total NOx minus background NOx) in a scatter graph (data taken from Table A15), with a trendline passing through zero and its derived equation.

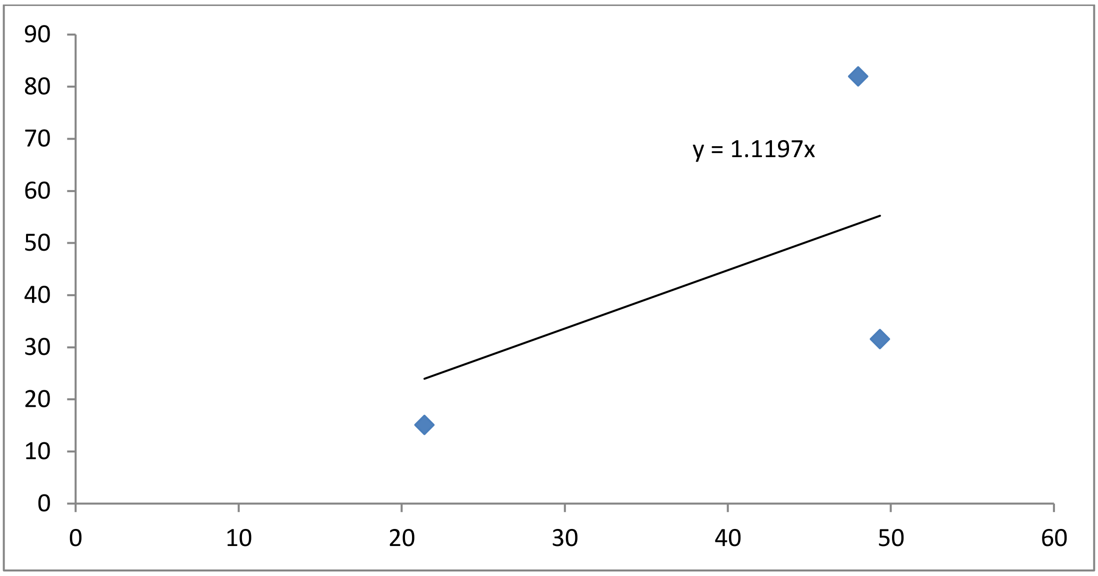

Figure A3: Unadjusted Modelled versus Monitored Annual Mean Roadside NO_x at the Monitoring Sites (µg/m³)

10.1.74 Consequently, in Table A16 the adjustment factor (1.1197) obtained from Figure A3 is applied to the modelled NOx Roadside concentrations to obtain improved agreement between monitored and modelled annual mean NOx. This has been converted to annual mean NO2 using the NOx:NO2 spreadsheet calculator.

Table A16: Adjusted Annual Average NO_2 Concentrations Compared to Monitored Annual Mean NO_2 Concentrations (µg/m³)

Site ID	Adjusted Modelled Road NO_x	Adjusted Modelled Total NO_x	Modelled Total NO_2	Monitored Total NO_2	% Difference
21	55.2	98.2	48.0	39.0	23.0
51	24.0	67.0	35.8	32.0	12.0
52	53.7	96.7	47.5	57.0	-16.8

10.1.75 The data in Table A17 shows following the application of the adjustment factor (of 1.1197), whilst the relationship between the monitored and modelled concentrations at Diffusion Tube 52 has slightly improved (from under predicting by 20.4% to under predicting by 16.8%), the adjustment factors lead to a greater over prediction and larger difference at Diffusion Tube 21 (from over predicting by 17.5% to 23%) and Diffusion Tube 51 (from over predicting by 8.6% to 12%).

10.1.76 To ensure the model is performing well a review of the traffic data (including traffic speeds) and monitoring data (including the height and location of Diffusion Tube 52) has been undertaken. Further information on the monitoring locations has also been received from the EHO at LBRuT, who has confirmed:

- Diffusion Tube 21 is set back 226m from Chalkers Junction and is located where traffic is less congested;
- Diffusion Tube 51 is not located on the queuing side of the traffic and as such is close to more freely flowing traffic; and

- Diffusion Tube 52 is 70m from the junction and is also on the opposite side of the road where traffic is less congested.

10.1.77 The above details have been considered in the model. It is considered that no further refinement can be undertaken and all modelling inputs have been included to reflect the known characteristics at the monitored locations.

10.1.78 Given the uncertainty above, to determine if the model verification (of 1.1197) should be used further statistical analysis on the performance of the model verification results have been undertaken using the methodology detailed in LAQM.TG(16) Box 7.17: Methods and Formulae for Description of Model Uncertainty. This additional statistical analysis calculation checks the performance of the model verification used and accuracy of the adjusted results (observed versus predicted).

10.1.79 The methodology for the calculations are presented in LAQM.TG(16) and represented below. The calculations have been undertaken using the formulas available within Microsoft Excel.

- **Correlation Coefficient:** This is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing a large number of model and observed data points.

$$r = \left[\frac{\sum_{i=1}^{N} (Obs_i - Avg.Obs)(Pred_i - Avg.Pred)}{Stdev.Obs \times Stdev.Pred} \right]$$

- **Fractional Bias:** This is used to identify if the model shows a systematic tendency to over or under predict. Values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.

$$FB = \frac{(Avg.Obs - Avg.Pred)}{0.5(Avg.Obs + Avg.Pred)}$$

- **Root Mean Square Error**: This is used to define the average error or uncertainty of the model. The units of the Root Mean Square Error are the same as the quantities compared.

$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(Obs_i - Pred_i)^2}$$

i = the number of observation compared, 1,2, 3 …. N, *N* = total number of observations compared, *Obs* = observed concentration, *Pred* = predicted concentration, *Avg.Obs* = average of all observed concentrations, *Avg.Pred* = average of all predicted concentrations, *Stdev.Obs* = standard deviation of observed concentrations, *Stdev.pred* = standard deviation of predicted concentrations

10.1.80 The results of the statistical calculation are presented in Table A17 following.

Table A17 – Statistical Calculations to Determine Degree of Error or Modelled Results

Statistical Calculation	Perfect Value[a]	Acceptable Variable Tolerance	Model Verification Source	
			Unadjusted	Adjusted
Correlation Coefficient	1	N/A	0.694	0.691
Fractional Bias	0	Between +2 to -2[a]	0.02	-0.03
Root Mean Square Error	0	Between $\pm$10[b]	4.6	4.5

As detailed in LAQM.TG(16) Box 7.17

As discussed in paragraph 7.541 of LAQM.TG(16)

10.1.81 The results presented in Table A17 show that there is very little difference between the unadjusted (without model verification) and adjusted (with the model verification of 1.1197) results and both sets of data are performing well and within the range of acceptable variable tolerances set out within the guidance. It is observed the correlation coefficient is marginally closer to 1 in the unadjusted scenario and marginally closer to 0 in the fractional bias. However, for the root mean square error the result in the adjusted scenario is closer to 0.

10.1.82 Given there is little difference when looking at the statistical calculations between the results without and with the model verification; the use of the model verification would result in worsening of the modelled results at Diffusion Tube 21 and Diffusion Tube 51; only a slight improvement would occur in the modelled result at Diffusion Tube 52 (which would remain as under predicting); and without the adjustment factor the model is over predicting at two out of the three monitoring sites, it is considered that adjustment is not necessary as the predicted results are already conservative and no further refinement can be undertaken.

Particulate Matter (PM_{10} and $PM_{2.5}$)

10.1.83 PM10 and PM2.5 monitoring data is not available for the Site area. Therefore, given that no model adjustment factor has been applied for the roadside modelled NOx (for the reasons set out above), no adjustment factor has been applied to the roadside PM10 and PM2.5 modelling results.

Verification Summary

10.1.84 Any atmospheric dispersion model study will always have a degree of inaccuracy due to a variety of factors. These include uncertainties in traffic emissions data, the differences between available meteorological data and the specific microclimate at each receptor location, and simplifications made in the model algorithms that describe the atmospheric dispersion and chemical processes. There will also be uncertainty in the comparison of predicted concentrations with monitored data, given the potential for errors and uncertainty in sampling methodology (technique, location, handling, and analysis) as well as processing of any monitoring data.

10.1.85 Whilst systematic under or over prediction can be taken in to account through the model verification / adjustment process, random errors will inevitably occur and a level of uncertainty will still exist in corrected / adjusted data.

10.1.86 While every effort has been made to reduce the uncertainties within the model and thus reduce the verification factor as much as possible, the model verification has been unable to be reduced further and maybe a result of:

- local microclimate experienced at the monitoring locations which the model cannot replicate;

- limited ability to assess the uncertainty of model inputs, for example, the actual emission rates of vehicles on the local road network (particularly in proximity to the monitors used for the verification) compared to the emission rates used within the model;
- the inability to model all contributions in the local area (e.g. all heating plants) due to a lack of available information (including emissions and locations of flues);
- sampling and measurement error associated with the monitoring sites used for the verification. Such as the duration of monitoring (over saturated samples), accuracy of written monitoring duration, collection and transportation errors (if the sample cap has been replaced properly) and errors in analysis; and
- whether the model itself completely describes all the necessary atmospheric and built form processes, such as the local microclimate experienced at the monitoring locations and the real world impact of the street canyon.

10.1.87 Having consideration of the above uncertainty, overall, it is concluded that without the adjustment factor applied to the ADMS-Roads, the model is performing well and modelled results are considered to be suitable to determine the effects of the Development on local air quality.

Assessor Experience

Name: Guido Pellizzaro

Years of Experience: 11

Qualifications:

- BSc (Hons)
- AIEMA (Associate Member of the Institute of Environmental Management and Assessment)
- MIAQM (Member of the Institute of Air Quality Management)
- Part of the All Party Parliamentary Group on Air Pollution

Guido has over eleven years of experience in the assessment of air quality and odour for a variety of environmental impact assessment projects. Guido has knowledge and extensive experience of designing and undertaking ambient air quality monitoring programmes using real time equipment and passive diffusion tubes. This includes devising monitoring programs for dust deposition, typically to monitor levels of dust generated during construction activities in populated areas where there is the potential for nuisance to be caused.

Guido has been responsible for the technical delivery of a wide range of air quality projects for a variety of clients in both the public and private sector. These projects include consideration of emissions from both transportation and industrial sources, through both monitoring and modelling, and therefore he has an in depth understanding of the regulatory requirements for these sources and the published technical guidance for their assessment.

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