APPENDIX 8.1 – TERMINOLOGY

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedence	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
ppb parts per billion	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppb means that for every billion (10^9) units of air, there is one unit of pollutant present.

Term	Definition
ppm parts per million	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppm means that for every billion (10^6) units of air, there is one unit of pollutant present.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
µg/m³ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1µg/m³ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

APPENDIX 8.2 - AIR QUALITY ASSESSMENT LEVELS

Air Quality Strategy Objective Levels			
Pollutant	**Standard (μg/m³)**	**Averaging Period**	**No. of Permitted Exceedances**
NO_2	200 (a)	1-Hour	18 per annum (99.8th percentile)
	40 (a)	Annual	-
PM_{10}	200 (a)	24-Hour	35 per annum (90.4th percentile)
	50 (a)	Annual	-
$PM_{2.5}$	25 (a)	Annual	-

(a) Air Quality Standards Regulations (2010)
(b) EU Directive Limit Value

APPENDIX 8.3 – SUMMARY OF TRAFFIC DATA

Table 8.3.1: Traffic Data

Description	Average Speed (kph)		2018 Baseline		2023 Without Development		2023 With Development	
	Freeflow	Junction/ Congestion	AADT Traffic Flows	HDV (%)	AADT Traffic Flows	HDV (%)	AADT Traffic Flows	HDV (%)
A2 New Rd	48	38	22594	2.3%	27751	1.5%	26681	1.3%
Magpie Hall Rd	48	38	4901	2.3%	5472	2.1%	5367	1.9%
A2 Chatham Hill	48	38	27947	3.8%	37667	4.3%	35292	3.3%
Luton Road	48	38	10655	5.1%	13844	7.1%	12889	4.5%
A2 Chatham Hill E	48	38	20464	2.7%	26864	2.5%	25533	2.3%
A2 Rainham Road	48	38	10879	3.0%	15686	2.5%	15822	2.6%
Ash Tree Lane N	48	38	4645	1.0%	6452	1.4%	6404	1.2%
A2	48	38	13313	3.1%	17183	2.2%	17273	2.1%
A2 Watling St	48	38	19457	3.1%	22956	3.0%	23362	3.1%
A2 Sovereign Blvd W	64	54	24609	2.9%	28020	3.2%	27981	3.0%
A2 sovereign Blvd E of	64	54	30612	2.7%	35183	3.0%	35239	2.8%
Ito Way	80	70	23156	2.1%	29356	2.2%	28598	2.4%
A2 Sovereign Blvd	64	54	36877	3.1%	44683	3.0%	43804	3.0%
A2 London Rd	64	54	23881	1.1%	24951	0.8%	24801	0.7%
Hoath Way N	80	70	28493	2.8%	37841	1.7%	36056	2.0%
Hoath Way W	48	38	7642	3.1%	12672	2.4%	12003	2.0%

Hoath Way E	48	38	5966	3.1%	7490	2.6%	7416	3.0%
Hoath Way	80	70	14884	2.7%	21564	1.8%	20062	2.2%
Hempstead Rd	48	38	11470	2.6%	16802	1.8%	17085	1.5%
Sharsted Way	48	38	14277	3.4%	19404	4.7%	19811	4.4%
Wigmore Road	48	38	14166	6.9%	18240	8.7%	18168	7.7%
Hoath Way S	80	70	40706	4.0%	56033	3.5%	53379	3.5%
M2 EB on	80	70	9012	4.1%	10477	3.8%	9965	4.5%
M2 EB off	80	70	12450	4.8%	18219	5.0%	17173	4.3%
M2 WB off	80	70	8498	2.8%	9885	1.3%	10122	1.7%
M2 WB on	80	70	10671	3.8%	17640	3.0%	16656	3.1%
Hempstead Rd	48	38	4170	7.6%	5958	6.1%	5516	6.8%
Hempstead Valley Dr	48	38	1874	2.7%	2466	4.9%	2369	3.7%
Pear Tree Lane	48	38	10854	2.4%	14451	2.3%	15075	3.0%
Capstone Road S	96	86	5693	2.4%	13346	1.6%	9405	1.8%
Capstone Road	48	38	10984	2.0%	19266	1.6%	16388	1.1%
Ash Tree Land S	96	86	13800	1.6%	19425	1.4%	18451	1.2%
Capstone Road W	48	38	18194	1.6%	21970	1.3%	12432	1.2%
Capstone Road W	48	38	10622	3.4%	14500	3.6%	11372	1.5%
Street End Rd	48	38	10005	3.1%	13098	3.6%	13115	3.6%
Luton High St	48	38	12599	4.3%	15328	5.6%	16581	3.3%
N Dane Way	64	54	18926	2.5%	22500	2.9%	13352	1.3%

Princes Ave	64	54	13028	2.9%	17918	3.3%	17625	1.5%
Shawstead Rd	96	86	1195	9.3%	6050	1.1%	-	-
N Dane Way	64	54	9949	1.4%	14430	1.4%	-	-
Lords Wood Ln	48	38	3840	1.8%	4738	2.3%	7464	1.0%
N Dane Way	64	54	7674	1.0%	11052	1.0%	12068	1.0%
Albermarle Rd	48	38	3675	5.0%	4261	7.5%	3976	8.2%
Lords Wood Ln	48	38	6038	3.9%	8491	4.7%	7551	4.6%
Walderslade Woods	48	38	15510	2.8%	23311	2.6%	22915	2.4%
Pear Tree Lane	48	38	10417	1.6%	17724	1.1%	20205	1.2%
N Dane Way (S of S access)	64	54	-	-	-	-	18215	1.1%
New Access S	48	38	-	-	-	-	7584	1.0%
New Link E	48	38	-	-	-	-	13764	1.2%
New Link N	48	38	-	-	-	-	24914	1.4%
New Link W	48	38	-	-	-	-	15282	1.3%
new link to Shawstead Rd	48	38	-	-	-	-	4857	1.0%
N Dane Way (N of S access)	64	54	-	-	-	-	10711	1.2%

APPENDIX 8.4 – VERIFICATION AND ADJUSTMENT OF MODELLED CONCENTRATIONS

Nitrogen Dioxide (NO_2)

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(16).

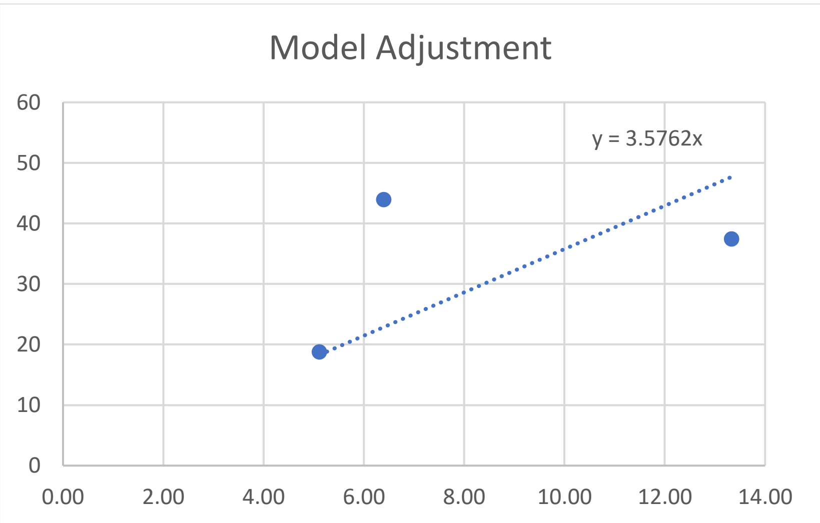
The model has been run to predict annual mean road-NO_x concentrations at three nearby monitoring sites.

The model output of road-NOx (i.e. the component of total NO_x coming from road traffic) has been compared to the 'measured' road-NO_x (Table 8.4.1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations by using the Defra NO_x to NO_2 calculator available on the UK-AIR website.

Table 8.4.1: Comparison of Modelled and Monitored NOx concentrations

Monitoring Location	Total Monitored NO_2	Total Monitored NOx	Background NO2	Background NOx	Monitored Road NOx	Modelled Road NOx	Ratio
DT05	34.2	59.7	15.9	22.3	37.4	13.3	2.81
DT09	25.5	41.1	15.9	22.3	18.7	5.1	3.67
DT04	37.9	67.6	16.9	23.7	43.9	6.4	6.87

Figure 8.4.1: Comparison of Modelled and Monitored Road NOx concentrations



The results in Table 8.4.1 and Figure 8.4.1 indicate that the ADMS model under-predicted the road NO_x concentrations at the selected monitoring sites. An adjustment factor was therefore determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution (3.58). This factor has then been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO_2 concentration was determined using the Defra NO_x:NO_2 spread sheet calculation tool and added to the background NO_2 concentration to produce a total adjusted NO_2 concentration.

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

There was insufficient roadside monitoring data available against which the modelling could be verified. Consequently, the verification factor determined above for adjusting the road-NO_x contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with guidance provided in LAQM.TG(16).

Model Uncertainty

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG(16) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. These include root mean square error (RMSE); fractional bias (FB) and correlation coefficient (CC). These parameters estimate how the model results agree or diverge from the observations. The simplest parameter to calculate and to interpret is the RMSE, which has therefore been used in this assessment to understand the model uncertainty.

The RMSE value calculated after verification was 6.1. Guidance provided in LAQM.TG(16) indicates that for RMSE values higher than 25% of the objective level, that the model should be revisited. For annual mean NO_2, which has an objective level of 40µg/m^3, this equates to 10µg/m^3. The RMSE value calculated for this assessment is therefore considered to fall within the acceptable limits, therefore the final predictions can be considered to be robust.

APPENDIX 8.5 – CONSTRUCTION MITIGATION MEASURES

It is recommended that the 'highly recommended' measures set out below are incorporated into a DMP and approved by MC prior to commencement of any work on site:

- develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site and the action taken to resolve the situation in the log book;
- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of the site boundary, with cleaning to be provided if necessary;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to MC when asked;
- increase frequency of site inspection by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged periods of dry or windy conditions;
- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles;
- fully enclose site or specific operations where there is a high potential for dust production and the activities are being undertaken for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If being re-used on site, cover as detailed below;
- cover, seed or fence stockpiles to prevent wind whipping;

- ensure all vehicles switch off engines when stationary - no idling vehicles;
- avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- impose and signpost a maximum speed limit of 15mph on surfaces and 10mph on un-surfaces haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate);
- produce a construction logistic plan to manage the sustainable delivery of goods and materials;
- implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car-sharing);
- only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- avoid bonfires and burning of waste materials;
- re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable;
- only remove the cover in small areas during work and not all at once;
- avoid scabbing (roughening of concrete surfaces) if possible;
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;

- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport;
- inspect on-site haul routes for integrity and instigate necessary repairs to the surfaces as soon as reasonably practicable;
- record all inspections of haul routes and any subsequent action in a site log book;
- install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud);
- ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit; and
- access gates to be located at least 10 m from receptors where possible.