

4 ASSESSMENT METHODOLOGY

4.1 Construction Phase

Dust is a major environmental concern associated with construction activities. Residents living in proximity to such a site can potentially be affected by site dust up to 1 km from the source, although continual or severe concerns about dust sources are most likely to be experienced near to dust sources, generally within 100 metres. In general, large dust particles (greater than 30 μm) make up the greatest proportion of dust emitted from construction sites and will largely deposit within 100 m of sources. Intermediate sized particles (10-30 μm) are likely to travel up to 250-500 m. Smaller particles (less than 10 μm), which make up a small proportion of the dust emitted, can travel up to 1km from sources⁸.

In November 2006, the Greater London Authority (GLA)⁹ released best practice guidance relating to the control of dust and emissions from construction and demolition sites. This guidance is widely referred to in assessments of construction impacts, even in areas outside London. However, the assessment methodology and significance criteria of potential impacts were outside the scope of the guidance document at the time of publication. As such, the Institute of Air Quality Management (IAQM) published guidance on the potential impacts of construction activities in collaboration with the GLA and the Building Research Establishment (BRE)¹⁰.

Based on this guidance, the main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM_{10} concentrations, as a result of dust generating activities on site; and
- An increase in concentrations of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment on site.

In relation to the most likely impacts, the guidance states the following:

“The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from activities on the site. Dust soiling will arise from the deposition of particulate matter in all size fractions, but will be associated mostly with particulate matter greater than 10 μm . Experience of assessing the exhaust emissions from on-site plant and

⁸ Minerals Policy Statement (MPS) 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England, Office of the Deputy Prime Minister, 2005

⁹ The control of dust and emissions from construction and demolition – Best Practice Guidance, produced in partnership by London Councils and the Greater London Authority, November 2006

¹⁰ Guidance of the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance, IAQM, January 2012



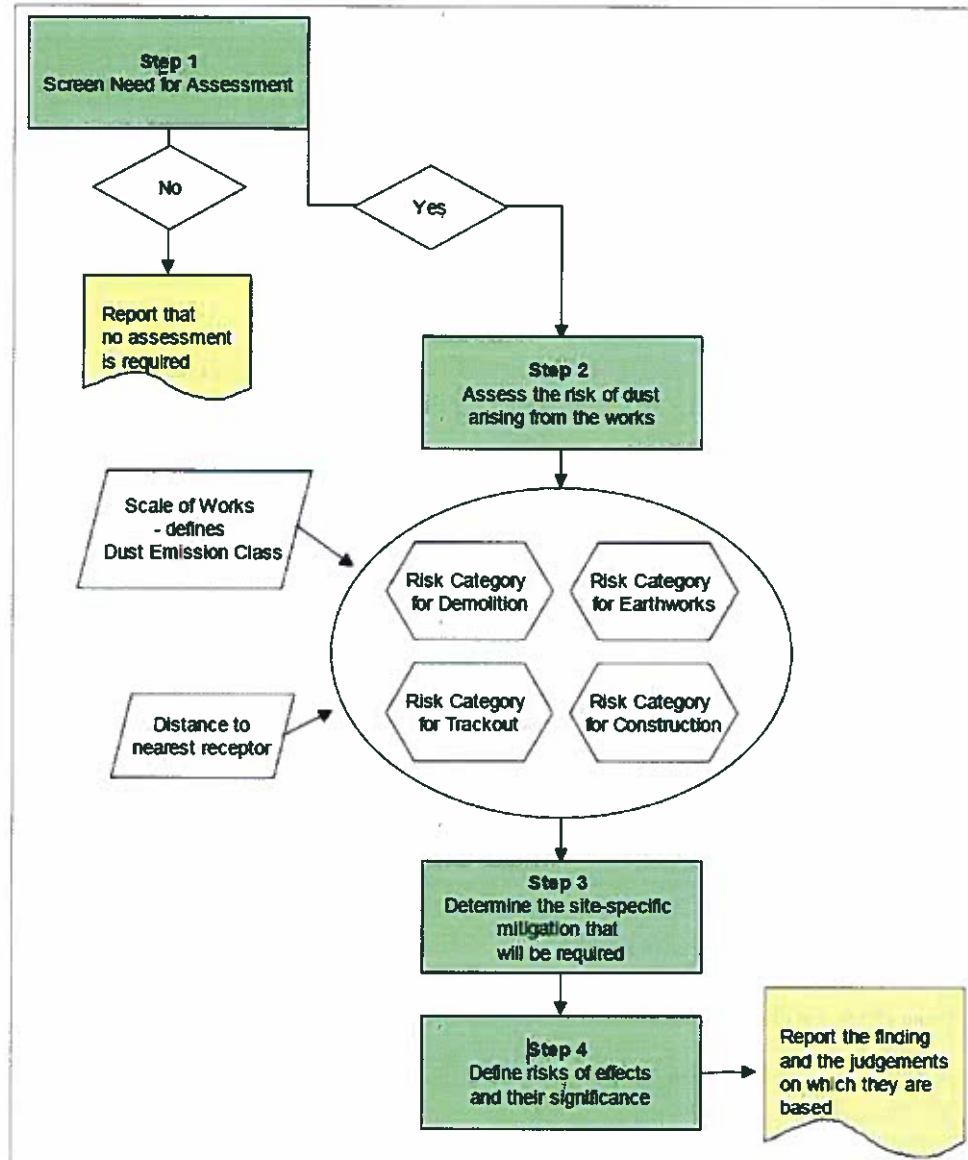
site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed”.

The guidance continues by providing an assessment procedure. This includes sub-dividing construction activities into four types to reflect their different potential impacts. These are as follows:

- Demolition;
- Earthworks;
- Construction; and
- Track out.

With regards to the proposed Aldi store the potential for dust emissions is assessed for each activity that is likely to take place. The assessment procedure assumes no mitigation measures are applied. The conditions with no mitigation thus form the baseline or “do-nothing” situation for a construction site. The assessment procedure uses the steps provided in the guidance and summarised in Figure 1.

Figure 1 – Dust Assessment Procedure



4.2 Operational Phase (Traffic Emissions)

4.2.1 Modelled Scenarios

A future year has been chosen (2018) for the assessment, along with the baseline year (2011). Overall, three scenarios have been adopted as part of the assessment. These are as follows:

- **Scenario 1** – existing levels of air quality / model verification (2011);
- **Scenario 2** – future baseline (2018);
- **Scenario 3** – future baseline (2018) + development traffic.

Scenarios 2 and 3 will be used to determine the potential impact on existing receptors adjacent to the modelled road network as a result of increased traffic levels generated by the proposed development in 2018.

Background pollutant concentrations and vehicle emission rates for all modelled years are based on the latest data issued by Defra in September 2012. These background concentrations and emission factors are discussed further in the following sections.

4.2.2 ADMS-Roads

Modelling the impact of traffic emissions on the proposed development will be undertaken using the latest version of the ADMS-Roads model¹¹. ADMS-Roads is significantly more advanced than that of most other air dispersion models in that it incorporates the latest understanding of the boundary layer structure, and goes beyond the simplistic Pasquill-Gifford stability categories method with explicit calculation of important parameters. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

4.2.3 Emission Factors

Defra and the Devolved Administrations have provided an updated Emission Factors Toolkit (Version 5.1) which incorporates updated NO_x emissions factors and vehicle fleet information¹². These emission factors have been integrated into the latest ADMS-Roads modelling software. However, in order to undertake a worst case assessment emission factors for 2011 have been used for all modelled years.

4.2.4 Traffic Data

Traffic flow data for the local links has been downloaded from the Department for Transport (DfT)¹³ for 2011 and has been projected to 2018 using Temprow and the NRTF.

¹¹ Interface Version 3.1.0, Build 2.39, Release Date 17 August 2011

¹² <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft>, August 2012

¹³ <http://www.dft.gov.uk/traffic-counts/index.php>

Modelled vehicle speeds have been provided in Table 3. These speeds are based on local speed limit data. Where a link approaches a junction a speed of 5 kph has been modelled in order to represent slow moving and queuing traffic.

Table 3 – Annual Average Daily Traffic Flows, Percentage HDV and Speeds for Selected Roads, Baseline 2011

Road / Link	Source	AADT	%HDV	Speed (kph)
M1	DfT	95,778	9.3%	113
A61 Sheffield Road, Birdwell (north of site)	DfT	15,315	4.6%	48
A61 Sheffield Road, Birdwell (south of site)	DfT	15,315	4.6%	48
A61, Junction 36	DfT	33,155	6.2%	48
A61 Westwood New Road	DfT	22,910	4.3%	48
A6195 Deane Valley Parkway	DfT	16,652	6.2%	48
A6135 Sheffield Road	DfT	14,065	2.2%	48

Development traffic flows have been provided by Transport Potential. Based on the data provided there will be 881 24-hour vehicle movements associated with the proposed Aldi store. Approximately 24% of these vehicle movements (208) will be to and from the north of the site with the remaining 68% (603) travelling to and from the south. The remaining 8% of development traffic will use The Walk and Rockingham Row. These links have not been assessed as part of this assessment due to low vehicle flow rates.

In order to undertake a worst case assessment at Junction 36 to the south of the site it has been assumed that there will be an increase of 603 vehicle movements across all the modelled links associated with the junction, including the M1. This is reflected in Table 4. It has been assumed that the %HDV and vehicle speeds will remain unchanged in 2018.

Table 4 – Future Annual Average Daily Traffic Flows, Including Development Traffic, 2018

Road / Link	Future Baseline	Future Baseline + Aldi Development
M1	107,175	107,778
A61 Sheffield Road, Birdwell (north of site)	17,137	17,345
A61 Sheffield Road, Birdwell (south of site)	17,137	17,740
A61, Junction 36	37,100	37,703
A61 Westwood New Road	25,636	26,239
A6195 Deane Valley Parkway	18,633	19,236
A6135 Sheffield Road	15,739	16,342

4.2.5 Street Canyons

A street canyon may be defined as a relatively narrow street with buildings on both sides. Street canyons may result in elevated pollutant concentrations from road traffic emissions due to a reduced likelihood of the pollutants becoming dispersed in the atmosphere. Street canyons have not been considered as part of this assessment.

4.3 Background Concentrations

Background NO_x, NO₂ and PM₁₀ concentrations have been obtained from Defra Local Air Quality Management (LAQM) support website¹⁴. These 1 km x 1 km grid resolution maps are derived from a base year of 2010 (for NO_x, NO₂, PM₁₀ and PM_{2.5} only), which are then projected to a future year (2011).

Table 5 – Background NO₂ and PM₁₀ Concentrations

Pollutant	X	Y	2011
NO ₂	434500	400500	23.3
NO _x			35.3
PM ₁₀			17.9

¹⁴ UK Air Quality Archive, <http://laqm.defra.gov.uk/maps/maps2010.html>

In order to undertake a worst case assessment, 2011 background concentrations have been assumed for all modelled scenarios.

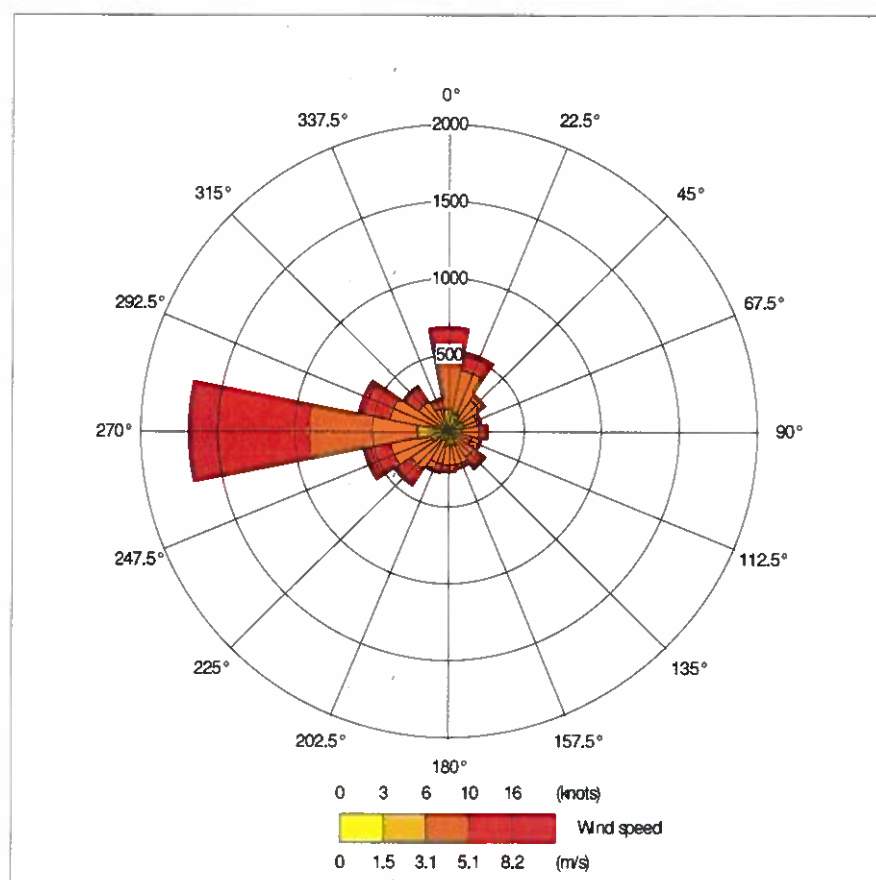
4.4 Surface Roughness

A surface roughness of 0.5 metres has been used in the model. This value is provided by ADMS-Roads as a typical roughness length for open suburbia. This value has been used across the modelled domain.

4.5 Meteorological Data

Hourly sequential meteorological data from the Leeds meteorological station has been used for all modelled years. Wind speed and direction data from the Leeds meteorological station has been plotted as a wind rose in Figure 2.

Figure 2 – Wind Speed and Direction Data, Leeds



4.6 Model Output

4.6.1 NO_x/NO₂ Relationship

Following recent evidence that shows the proportion of primary NO₂ in vehicle exhaust has increased¹⁵. As such, a new NO_x to NO₂ calculator has been devised¹⁶. This new calculator has been used to determine NO₂ concentrations for this assessment, based on predicted NO_x concentrations using ADMS-Roads. Converted NO₂ concentrations are initially compared to local monitoring data in order to verify the model output. If the model performance is considered unacceptable then the NO_x concentrations are adjusted before conversion to NO₂.

4.6.2 Predicted Short Term Concentrations

As discussed in the introduction, it has not been possible to model the short term impacts of NO₂ and PM₁₀. Research undertaken in 2003¹⁷ has indicated that the hourly NO₂ objective is unlikely to be exceeded at a roadside location where the annual mean NO₂ concentration is less than 60 µg/m³.

For PM₁₀, a relationship between the annual mean and the number of 24-hour mean exceedences has been devised and is as follows:

- No. 24-hour mean exceedences = $-18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$

This relationship has been applied to the modelled annual mean concentrations in order to estimate the number of 24-hourly exceedences.

4.6.3 Model Verification

Barnsley Metropolitan Borough Council undertakes monitoring of NO₂ and PM₁₀ at a number of roadside locations. Monitored NO₂ concentrations from the diffusion tubes located near the M1 Junction 36 have been used for the purposes of model verification. The location of these diffusion tubes is provided in Table 6.

There are no PM₁₀ monitoring stations adjacent to the modelled network. As such, it has not been possible to verify predicted PM₁₀ concentrations.

¹⁵ Trends in Primary Nitrogen Dioxide in the UK, Air Quality Expert Group, 2007

¹⁶ <http://lagm.defra.gov.uk/documents/NOx-NO2-Calculator-v3.2.xls>

¹⁷ Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marnier, 2003

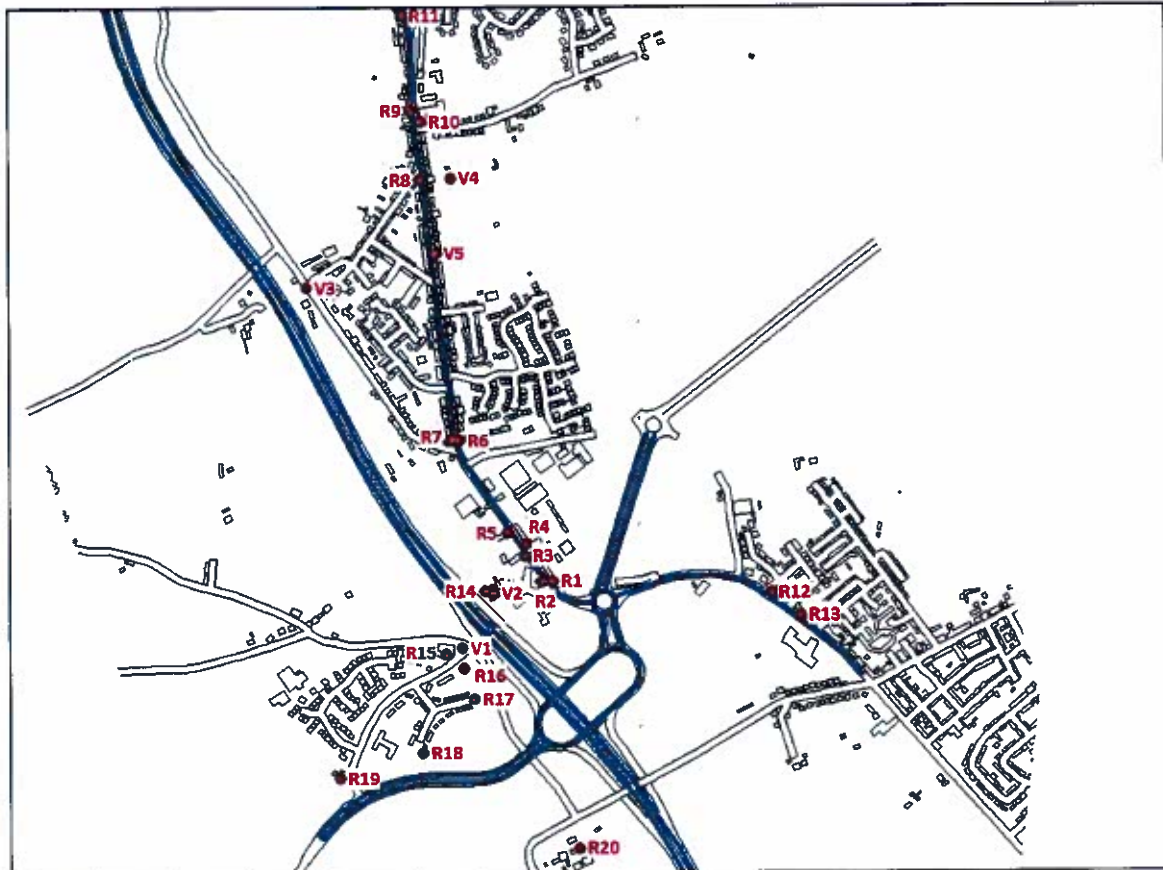
4.6.4 Receptor Locations

A description of modelled receptors, together with their height above ground level (modelled at 0 metres) is provided in Table 6. Their location is provided in Figure 3, together with the modelled road network (in blue). Existing receptors have been chosen that represent sensitive receptors adjacent to those roads where an increase in traffic flows following completion of the development are considered significant.

Table 6 – Modelled Receptor Locations

Receptor	Coordinate Location		Receptor Height (m)	Receptor Description
	X	Y		
V1	434652	400231	2.0	Tankersley School Diffusion Tube
V2	434721	400352	2.0	5, Moor Lane, Birdwell Diffusion Tube
V3	434309	401032	2.0	Cock Inn, Birdwell Diffusion Tube
V4	434630	401274	2.0	Sheffield Rd, Birdwell Diffusion Tube
V5	434595	401107	2.0	Sheffield Road, Birdwell Diffusion Tube
R1	434854	400379	1.5	Existing receptors. See Figure 3 for modelled locations.
R2	434833	400379	1.5	
R3	434791	400436	1.5	
R4	434797	400462	1.5	
R5	434753	400486	1.5	
R6	434648	400691	1.5	
R7	434628	400695	1.5	
R8	434560	401271	1.5	
R9	434539	401424	1.5	
R10	434564	401399	1.5	
R11	434521	401635	1.5	
R12	435337	400353	1.5	
R13	435404	400303	1.5	
R14	434704	400356	1.5	
R15	434615	400218	1.5	
R16	434657	400187	1.5	
R17	434680	400119	1.5	
R18	434564	399999	1.5	
R19	434380	399943	1.5	
R20	434912	399786	1.5	

Figure 3 – Modelled Receptor Locations



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4.7 Significance Criteria

4.7.1 Construction Phase

Assessing the risk of dust arising from the construction site (see Step 2, Figure 1) has used the emission classifications provided in Table 7. The overall risk is then defined (Table 8) based on the distance of relevant receptors to the construction activity.

Table 7 – Dust Emission Classifications Applicable to the Construction Site

Activity	Dust Emission Class		
	Large	Medium	Small
Demolition	Total building volume >50,000 m ³ , potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level	Total building volume 20,000 – 50 000m ³ , potentially dusty construction material, demolition activities 10-20 m above ground level	Total building volume <20,000 m 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	Total site area >10,000 m ² , potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes	Total site area 2,500 – 10,000 m ² , moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes	Total site area <2,500 m ² , soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	Total building volume >100,000 m ³ , piling, on site concrete batching; sandblasting	Total building volume 25,000 m ³ – 100,000 m ³ , potentially dusty construction material (e.g. concrete), piling, on site concrete batching	Total building volume <25,000 m ³ , construction material with low potential for dust release (e.g. metal cladding or timber)
Track out	>100 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m	25-100 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100 m;	<25 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Table 8 – Risk Categories for each Construction Activity

Construction Activity	Distance to Nearest Receptor (m)		Dust Emission Class		
	Dust Soiling & PM ₁₀	Ecological	Large	Medium	Small
Demolition	<20	--	High Risk Site	High Risk Site	Medium Risk Site
	20 – 100	<20	High Risk Site	Medium Risk Site	Low Risk Site
	100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Low Risk Site
	200 – 350	40 – 100	Medium Risk Site	Low Risk Site	Negligible
Earthworks	<20	--	High Risk Site	High Risk Site	Medium Risk Site
	20 – 50	--	High Risk Site	Medium Risk Site	Low Risk Site
	50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
	100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
	200 – 350	40 – 100	Low Risk Site	Low Risk Site	Negligible
Construction	<20	--	High Risk Site	High Risk Site	Medium Risk Site
	20 – 50	--	High Risk Site	Medium Risk Site	Low Risk Site
	50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
	100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
	200 – 350	40 – 100	Low Risk Site	Low Risk Site	Negligible
Track out	<20	--	High Risk Site	Medium Risk Site	Medium Risk Site
	20 – 50	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
	50 – 100	20 – 100	Low Risk Site	Low Risk Site	Negligible

In order to undertake Step 4 (Figure 1) and determine the significance of potential dust effects professional judgement must be used, taking into account the factors that define the sensitivity of the surround area and overall pattern of potential risks derived from Table 8. Based on the IAQM guidance, the sensitivity of the surrounding area may be defined using the criteria provided in Table 9.

Table 9 – Factors Defining Sensitivity of an Area

Sensitivity of Surrounding Area	Human Receptors	Ecological Receptors
Very High	Very densely populated area. More than 100 dwellings within 20 m. Local PM ₁₀ concentrations exceed the objective. Contaminated buildings present. Very sensitive receptors (e.g. oncology units). Works continuing in one area of the site for more than one year.	European Designated site
High	Densely populated area. 10-100 dwellings within 20 m of site. Local PM ₁₀ concentrations close to the objective (e.g. annual mean 36-40 µg/m ³). Commercially sensitive horticultural land within 20m.	Nationally Designated site
Medium	Suburban or edge of town area. Less than 10 dwellings within 20 m. Local PM ₁₀ concentrations below the objective (e.g. annual mean 30-36 µg/m ³).	Locally designated site
Low	Rural area; industrial area No dwellings within 20 m Local PM ₁₀ concentrations well below the objectives (less than 75%) Wooded area between site and receptors	No designations

The sensitivity of the area surrounding the construction site is combined with the risk of the site giving rise to dust effects to define the significance of the effects for each of the four activities (demolition, earthworks, construction and track out). The significance of effects may be defined with and without mitigation for each activity, as detailed in the following tables.

Table 10 – Significance of Effects for each Activity with No Mitigation

Sensitivity of Surrounding Area	Risk of Site Giving Rise to Dust Effects		
	High Risk Site	Medium Risk Site	Low Risk Site
Very High	Substantial adverse	Moderate adverse	Moderate adverse
High	Moderate adverse	Moderate adverse	Slight adverse
Medium	Moderate adverse	Slight adverse	Negligible
Low	Slight adverse	Negligible	Negligible



Table 11 – Significance of Effects for each Activity with Mitigation

Sensitivity of Surrounding Area	Risk of Site Giving Rise to Dust Effects		
	High Risk Site	Medium Risk Site	Low Risk Site
Very High	Slight adverse	Slight adverse	Negligible
High	Slight adverse	Negligible	Negligible
Medium	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Negligible

The final step is to determine the overall significance of the effects arising from the construction phase of a proposed development. An overall summary table has been produced illustrating the potential effects with and without mitigation.

4.7.2 Operational Phase

The significance of emissions will be determined by comparing the predicted results to the Air Pollution Exposure Criteria (APEC) detailed in the *Air Quality and Planning Guidance* written by the London Air Pollution Planning and the Local Environment (APPLE) working group¹⁸. The Air Pollution Exposure Criteria is considered appropriate to describe the significance of the impacts predicted, together with an indication as to the level of mitigation required in order for the development to be approved. The APEC table is provided below.

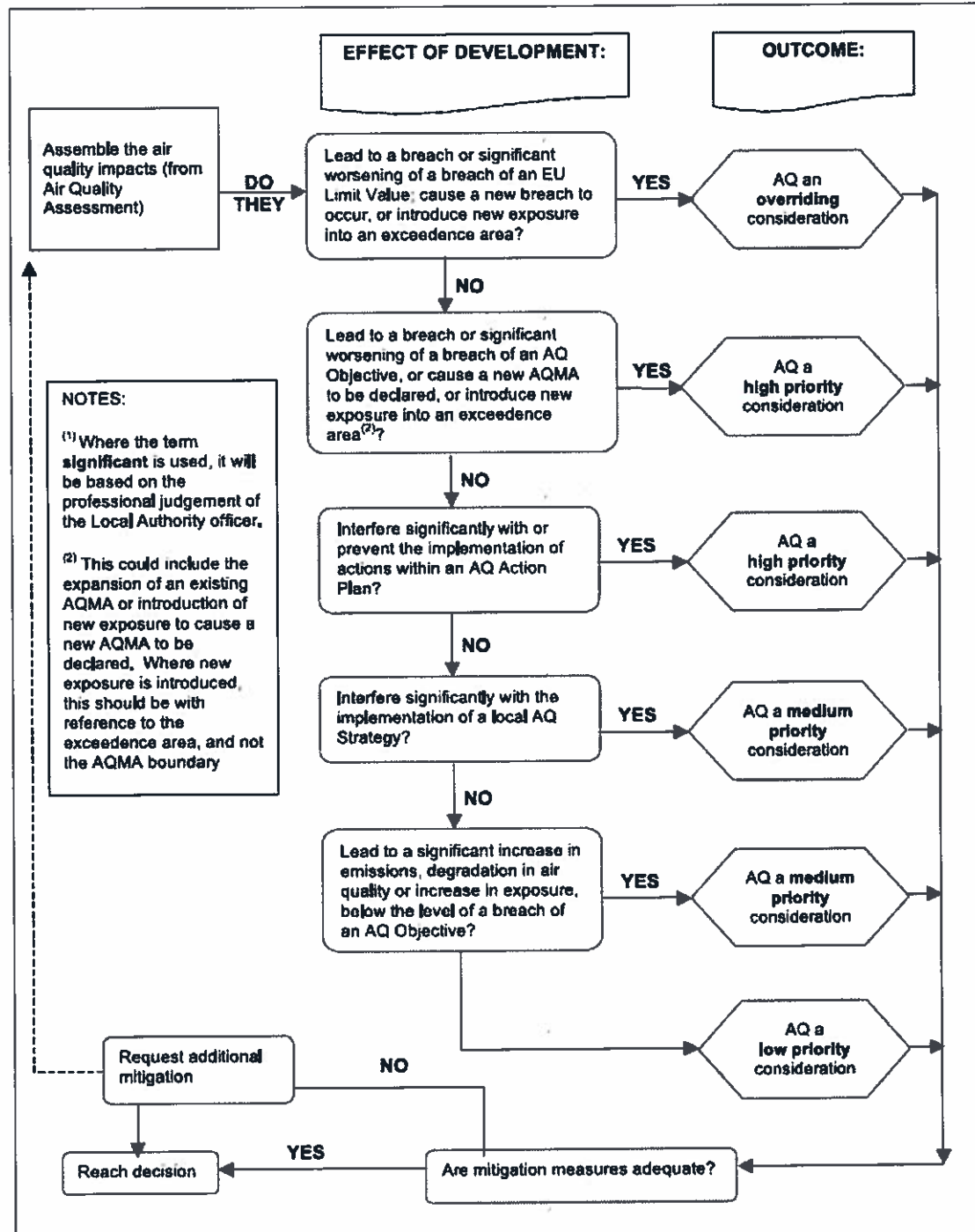
Table 12 – Air Pollution Exposure Criteria (APEC)

APEC Category	NO ₂	PM ₁₀	Recommendations
A	>5% below national annual mean objective	>5% below national annual mean objective >1-day less than national 24-hour objective	No air quality grounds for refusal; however mitigation of any emissions should be considered.
B	Between 5% below or above national annual mean objective	Between 5% above or below national annual mean objective Between 1-day above or below national 24-hour objective	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered
C	>5% above national annual mean objective	>5% above national annual mean objective >1-day more than national 24-hour objective	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated

Furthermore, the guidance released by Environmental Protection UK also provides steps for a Local Authority to follow in order to assess the significance of air quality impacts of a development proposal. This procedure, shown in Figure 4, has also been applied to the modelled results.

¹⁸ Air Quality and Planning Guidance, written by the London Air Pollution Planning and the Local Environment (APPLE) working group, January 2007

Figure 4 – Assessing the Significance of Air Quality Impacts of a Development Proposal



The guidance released by Environmental Protection UK also provides descriptors for impact magnitude and impact significance in air quality assessments. This is important when determining the magnitude and significance of any changes in air quality as a result of the proposed development. Table 13 provides descriptions for changes in ambient annual means concentrations of NO₂ and PM₁₀. Descriptors for changes to the number of days with PM₁₀ concentration greater than 50 µg/m³ are also provided in Table 13. Table 14 provides air quality impact descriptors for changes to the annual mean NO₂ and PM₁₀ concentrations. Table 15 provides air quality impact descriptors for changes to the number of days with PM₁₀ concentration greater than 50 µg/m³.

Table 13 – Descriptors for Changes in Ambient Concentrations of NO₂ and PM₁₀

Magnitude of Change	Annual Mean NO ₂ / PM ₁₀	Days PM ₁₀ >50 µg/m ³
Large	Increase/decrease >4 µg/m ³	Increase/decrease >4 days
Medium	Increase/decrease 2 – 4 µg/m ³	Increase/decrease 2 – 4 days
Small	Increase/decrease 0.4 – 2 µg/m ³	Increase/decrease 1 – 2 days
Imperceptible	Increase/decrease <0.4 µg/m ³	Increase/decrease <1 day

Table 14 – Descriptors for Impact Significance for Annual Mean NO₂ and PM₁₀

Absolute Concentration in Relation to Objective	Change in Concentration		
	Small	Medium	Large
Increase with the Scheme			
Above Objective With Scheme (>40 µg/m ³)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective With Scheme (36-40µg/m ³)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective With Scheme (30-36 µg/m ³)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective With Scheme (<30 µg/m ³)	Negligible	Negligible	Slight Adverse
Decrease with the Scheme			
Above Objective Without Scheme (>40 µg/m ³)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective Without Scheme (36-40µg/m ³)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective Without Scheme (30-36 µg/m ³)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective Without Scheme (<30 µg/m ³)	Negligible	Negligible	Slight Beneficial

Table 15 – Air Quality Impact Descriptors for Changes to Number of Days with PM₁₀ Concentration Greater than 50 µg/m³

Absolute Concentration in Relation to Objective	Change in Concentration		
	Small	Medium	Large
Increase with the Scheme			
Above Objective With Scheme (>35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective With Scheme (32-35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective With Scheme (26-32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective With Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with the Scheme			
Above Objective Without Scheme (>35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective Without Scheme (32-35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective Without Scheme (26-32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective Without Scheme (<26 days)	Negligible	Negligible	Slight Beneficial