Chapter 9:

Air Quality and Climate

9.0 AIR QUALITY AND CLIMATE

9.1 INTRODUCTION

Planning permission is being sought for a residential extension consisting of three levels over the Frascati Centre, which is currently at an advance stage of construction under the permission granted for the rejuvenation of the Frascati Shopping Centre in Blackrock, Co. Dublin.

AWN Consulting Limited has been commissioned to conduct an assessment into the likely air quality and climate impacts associated with the proposed development. This chapter has been prepared by Ciara Nolan, Environmental Consultant BSc MSc AMIAQM AMIEnvSc.

9.1.1 Background Information

Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "*Air Quality Standards*" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 9.1 and Appendix 9.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC, which has set limit values for NO_2, PM_{10}, $PM_{2.5}$, benzene and CO (see Table 9.1). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 9.1).

Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and the EU ambient air quality standards outlined in Table 9.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regards to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been stipulated for nuisance dust in respect of this development.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust)(1) sets a maximum permissible immission level for dust deposition of 350 mg/(m^2*day) averaged over a one year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Health & Local Government(2) apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the proposed development.

Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002(2,3). For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012(4,5). The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emissions Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP23) took place in Bonn, Germany from the 6th to the 17th of November 2017 and focussed on advancing the implementation of the Paris Agreement. The Paris Agreement was established at COP21 in Paris in 2015 and is an important milestone in terms of international climate change agreements. The "Paris Agreement", agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions.

The EU, on the 23rd/24th of October 2014, agreed the "2030 Climate and Energy Policy Framework"(7). The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25 kt for SO_2 (65% on 2005 levels), 65 kt for NO_X (49% reduction on 2005 levels), 43 kt for VOCs (25% reduction on 2005 levels), 108 kt for NH_3 (1% reduction on 2005 levels) and 10 kt for $PM_{2.5}$ (18% reduction on 2005 levels).

European Commission Directive 2001/81/EC, the National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005(7,8). Data available from the EU in 2010 indicated that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3 but failed to comply with the ceiling for NO_X(9). Directive (EU) 2016/2284 "*On the Reduction of National Emissions of Certain Atmospheric Pollutants and Amending Directive 2003/35/EC and Repealing Directive 2001/81/EC*" was published in December 2016. The Directive will apply the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49% reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (85% below 2005 levels), for NO_X (69% reduction), for VOCs (32% reduction), for NH_3 (5% reduction) and for $PM_{2.5}$ (41% reduction).

Table 9.1 Air Quality Standards Regulations 2011 (based on EU Council Directive 2008/50/EC)

Pollutant	Regulation Note 1	Limit Type	Value
Nitrogen Dioxide (NO_2)	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
		Critical level for protection of vegetation	30 µg/m^3 NO + NO_2
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3
Benzene	2008/50/EC	Annual limit for protection of human health	5 µg/m^3
Carbon Monoxide (CO)	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	10 mg/m^3 (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

9.2 STUDY METHODOLOGY

Construction Stage

The Institute of Air Quality Management in the UK (IAQM) guidelines[10] outline an assessment method for predicting the impact of dust emissions from demolition, earthworks, construction and haulage activities based on the scale & nature of the works and the sensitivity of the area to dust impacts. The IAQM methodology has been applied to the construction phase of this development in order to predict the likely magnitude of the dust impacts in the absence of mitigation measures.

Operational Stage

The air quality assessment is carried out following procedures described in the publications by the EPA[11,12] and using the methodology outlined in the guidance documents published by the UK DEFRA[13 - 17]. The assessment of air quality is carried out using a phased approach as recommended by the UK DEFRA[14]. The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of possible key pollutants was carried out and the likely location of air pollution "*hot-spots*" identified. An examination of recent EPA and Local Authority data in Ireland[18,19] has indicated that SO_2, smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential issues in regards to nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$ at busy junctions in urban centres[18,19]. Benzene, although previously reported at quite high levels in urban centres, has recently been measured at several city centre locations to be well below the EU limit value[20-21]. Historically, CO levels in urban areas were a cause for concern. However, CO concentrations have decreased significantly over the past number of years and are now measured to be well below the limits even in urban centres[18,19]. The key pollutants reviewed in the assessments are NO_2, PM_{10}, $PM_{2.5}$, benzene and CO, with particular focus on NO_2 and PM_{10}.

The assessment methodology involves air dispersion modelling using the UK DMRB Screening Model[16] (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet[20] (Version 6.1, October 2017), and following guidance issued by the TII[21], UK Highways Agency[16], UK DEFRA[13-17] and the EPA[11,12].

The TII guidance[21] states that the assessment must progress to detailed modelling if:

- Concentrations exceed 90% of the air quality limit values when assessed by the screening method; or
- Sensitive receptors exist within 50m of a complex road layout (e.g. grade separated junctions, hills etc).

The UK DMRB guidance[15], on which the TII guidance was based, states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGV flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

The proposed residential extension will increase traffic levels by at most 0.5% during peak times, therefore, none of the road links impacted by the proposed development satisfy the above criteria and an assessment of the impact of traffic emissions on ambient air quality is not necessary.

9.3 EXISTING RECEIVING ENVIRONMENT

Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels)[22]. Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Dublin Airport, which is located approximately 13 km north of the site. Dublin Airport met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 9.1). For data collated during five representative years (2012 - 2016), the predominant wind direction is south-westerly. The average wind speed over the period 1981 – 2010 is approximately 5.3 m/s.

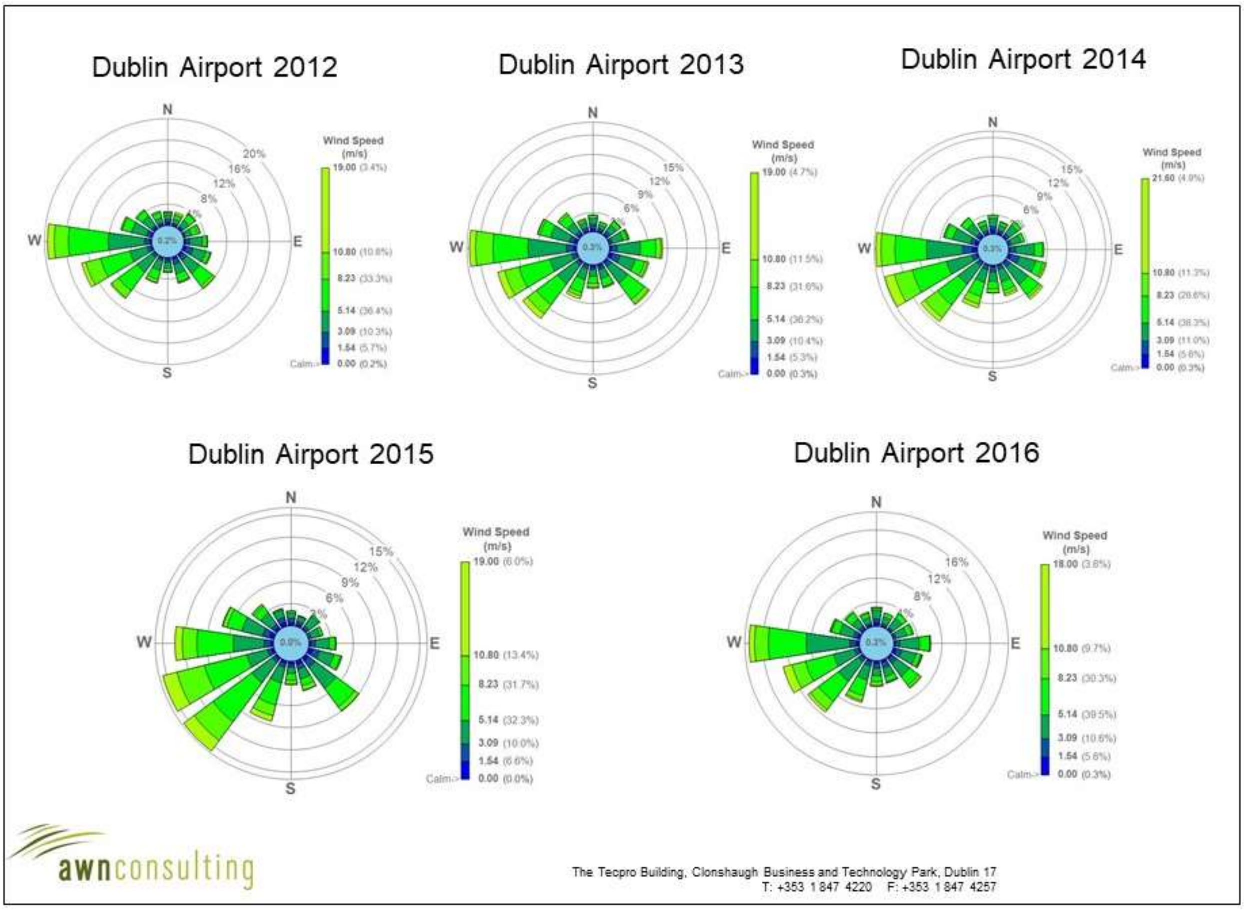

Figure 9.1 Dublin Airport Windrose 2012 - 2016

Baseline Air Quality – Review of Available Background Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is the "*Air Quality In Ireland 2016 – Indicators of Air Quality*"(19). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments(18).

In terms of air monitoring and assessment, Blackrock is within the Zone A Dublin region(19). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

With regard to NO_2, continuous monitoring data from the EPA(18,19) at the Zone A locations of Winetavern Street, Rathmines, Blanchardstown, Dún Laoghaire and Swords show that levels of NO_2 are below both the annual and 1-hour limit values (see Table 9.2), with average long-term concentrations ranging from 13 - 37 µg/m^3 for the period 2012 - 2016. There were four exceedances (in Swords) of the maximum 1 hour limit of 200 µg/m^3 in any one year (18 exceedances are allowed per year). The most representative monitoring station is Dún Laoghaire, which is located approximately 3 km south-east of the site has an average annual mean concentration of 16.7 µg/m^3 over the five year period. Based on these results and keeping regard for the greater distance from the city centre to the site, a conservative estimate of the background NO_2 concentration in the region of the proposed development is 18 µg/m^3.

Table 9.2 Trends In Trends In Dublin City Air Quality – NO_2[18,19]

Station	Averaging Period Notes 1, 2	Year				
		2012	2013	2014	2015	2016
Winetavern Street	Annual Mean NO_2 (µg/m^3)	29	31	31	31	37
	Max 1-hr NO_2 (µg/m^3)	136	158	188	182	194
Rathmines	Annual Mean NO_2 (µg/m^3)	21	19	17	18	20
	Max 1-hr NO_2 (µg/m^3)	138	107	112	106	102
Blanchardstown	Annual Mean NO_2 (µg/m^3)	30	29	31	25	30
	Max 1-hr NO_2 (µg/m^3)	194	154	215	178	160
Dún Laoghaire	Annual Mean NO_2 (µg/m^3)	18	16	15	16	19
	Max 1-hr NO_2 (µg/m^3)	136	123	105	103	142
Swords	Annual Mean NO_2 (µg/m^3)	15	15	14	13	16
	Max 1-hr NO_2 (µg/m^3)	241	211	325	170	206

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
Note 2 1-hour limit value - 200 µg/m^3 as a 99.8th%ile, i.e. not to be exceeded >18 times per year (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Continuous PM_{10} monitoring carried out at the locations of Winetavern Street, Rathmines, Phoenix Park and Dún Laoghaire showed 2012 - 2016 annual mean concentrations ranging from 11 – 17 µg/m^3 (Table 9.3), with at most 8 exceedances (in Rathmines) of the 24-hour limit value of 50 µg/m^3 (35 exceedances are permitted per year)[19]. Results for the 2012 – 2016 period suggest an upper average PM_{10} concentration of no more than 15 µg/m^3. Based on the EPA data (Table 9.3) a conservative estimate of the current background PM_{10} concentration in the region of the site is 15 µg/m^3.

Table 9.3 Trends In Trends In Dublin City Air Quality - PM_{10}[18,19]

Station	Averaging Period Notes 1, 2	Year				
		2012	2013	2014	2015	2016
Winetavern Street	Annual Mean PM_{10} (µg/m^3)	13	14	14	14	14
	24-hr Mean > 50 µg/m^3 (days)	0	3	1	4	2
Rathmines	Annual Mean PM_{10} (µg/m^3)	14	17	14	15	15
	24-hr Mean > 50 µg/m^3 (days)	2	8	3	5	3
Phoenix Park	Annual Mean PM_{10} (µg/m^3)	11	14	12	12	11
	24-hr Mean > 50 µg/m^3 (days)	0	3	0	2	0
Dún Laoghaire	Annual Mean PM_{10} (µg/m^3)	12	17	14	13	13
	24-hr Mean > 50 µg/m^3 (days)	1	5	2	3	0

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
Note 2 24-hour limit value - 50 µg/m^3 as a 90.4th%ile, i.e. not to be exceeded >35 times per year (EU Council Directive 1999/30/EC & S.I. No. 180 of 2011).

Continuous $PM_{2.5}$ monitoring carried out at the Zone A location of Rathmines showed $PM_{2.5}/PM_{10}$ ratios ranging from 0.64 – 0.79 over the period 2012 – 2016. Based on this information, a ratio of 0.8 was used to generate a background $PM_{2.5}$ concentration in the region of the site of 12 µg/m^3.

Sensitivity of the Receiving Environment

In line with the IAQM guidance document(10) prior to assessing the impact of dust from a proposed development the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity.

In terms of receptor sensitivity to dust soiling, there are approximately 12 houses and 1 apartment complex (high sensitivity receptors) located within 20 m of the proposed development site. Based on the IAQM criteria outlined in Table 9.4, the worst case sensitivity of the area to dust soiling is considered to be **high**.

Table 9.4 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number Of Receptors	Distance from 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

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity based on type and the number of receptors affected within various distance bands from the construction works. A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the proposed development is estimated to be 15 µg/m^3 and there are approximately 13 high sensitivity receptors located within 20 m of the proposed works. Based on the IAQM criteria outlined in Table 9.5, the worst case sensitivity of the area to human health is considered to be **low**.

Table 9.5 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number Of Receptors	Distance from source (m)			
			<20	<50	<100	<200
High	< 24 µg/m^3	>100	Medium	Low	Low	Low
		10-100	**Low**	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	< 24 µg/m^3	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	< 24 µg/m^3	>1	Low	Low	Low	Low

9.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

Planning permission is being sought for a residential extension to the Rejuvenated Frascati Shopping Centre, which is at an advanced stage of construction at present, within the designed district centre of Blackrock.

The proposal is for a residential development of 45 no. apartment units over 3 no. storeys, from second to fourth floor level, over the permitted ground and first floor levels of retail / restaurant floorspace and permitted lower ground floor car park. The proposal will be an extension of the Rejuvenation Scheme permitted under Reg. Ref.: D14A/0134 (which was the subject of an EIS), as amended by Reg. Ref.: D16A/0235 / ABP Ref.: PL 06D.246810, Reg. Ref.: D16A/0798, Reg. Ref.: D16A/0843 and Reg. Ref.: D17A/0599.

The proposed apartment mix consists of 3 no. 1 bed units, 36 no. 2 bed units and 6 no. 3 bed units. Balconies are provided for the residential apartments on the north eastern, north western, south eastern and south western elevations. Access to the residential units will be provided via a stair and lift core from lower ground and ground floor level. 51 no. car parking spaces within the lower ground floor car park will be allocated to the residential units. The development includes 54 no. bicycle parking spaces for the apartments, located at lower ground floor level and the proposed first floor level podium car park. The development also includes a bin store and plant area at lower ground floor level, two communal terrace areas at second floor level and roof level and plant enclosures at roof level. The development includes an associated reduction to the permitted footprint of the lower ground floor level. The proposal will result in the omission of the second floor level restaurant unit and storage floorspace permitted under the Rejuvenation Scheme.

The proposal includes a first floor level podium car park, over the permitted podium car park, located at the north west of the site, which will provide 81 no. car parking spaces. The total car parking provision for the scheme as amended by this permission will be 604 no. spaces, which comprises of 51 no. spaces for the proposed residential units and 553 no. spaces for the permitted retail and restaurant floorspace. The application site area is 0.625 ha.

The proposal is an extension of the Rejuvenation of Frascati Shopping Centre, which is currently at an advanced stage of construction, and which related to an overall application site area of approximately 3.41 hectares, including the Frascati Road area included in the red line boundary of that application, the development site area, i.e. excluding Frascati Road, is 2.7 hectares. The development comprises primarily of the improvement of the current retail offer within the centre, along with the inclusion of additional retail services floorspace, the provision of additional café/restaurant floorspace and the reorganisation of the current car parking provision and access and circulation system.

The basement area, which will accommodate the car parking area for the residential units, has been constructed and the replacement car parking for the retail floorspace is proposed in an additional podium level as part of this residential extension application.

9.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

Construction phase

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction.

It is important to note that the potential impacts associated with the construction phase of the proposed development are short-term in nature. When the dust minimisation measures detailed in Appendix 9.2 of this section are implemented, fugitive emissions of dust from the site will not be significant and will pose no nuisance at nearby receptors.

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the previously established sensitivity of the area (see Section 9.3). The major dust generating activities are divided into four types within the IAQM guidance to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (movement of heavy vehicles).

Demolition

There is no demolition required as part of the proposed development. All required demolition works were undertaken as part of the previously approved planning applications for the Rejuvenation Scheme.

Earthworks

Earthworks typically involve excavating material, loading and unloading of materials, tipping and stockpiling activities. Activities such as levelling the site and landscaping works are also considered under this category. All earthworks have been or will be undertaken as part of the previously approved Rejuvenation Scheme which is at an advanced construction stage. The proposed residential development will be located above the previously approved shops on the ground and first floors for which earthworks were undertaken and assessed as part of that planning application and amendments.

Construction

Dust emission magnitude from construction can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

Large: Total building volume > 100,000 m^3, on-site concrete batching, sandblasting;

Medium: Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching;

Small: Total building volume < 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The dust emission magnitude for the proposed construction activities can be classified as medium as a worst-case as the total volume of the new buildings will be between 25,000 m^3 – 100,000 m^3, but there is unlikely to be any on-site concrete batching.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 9.6, this results in an overall **medium risk** of temporary dust soiling impacts and an overall **low risk** to human health impacts as a result of the proposed construction activities.

Table 9.6 Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	**Medium Risk**	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	**Low Risk**	Negligible

Trackout

Factors which determine the dust emission magnitude are vehicle size, vehicle speed, number of vehicles, road surface material and duration of movement. Dust emission magnitude from trackout can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

Large: > 50 HGV (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100 m;

Medium: 10 - 50 HGV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100 m;

Small: < 10 HGV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.

The dust emission magnitude for the proposed trackout can be classified as small as worst-case as there are likely to be less than 10 HGV movements per day.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 9.7, this results in an overall **low risk** of temporary dust soiling impacts and a **negligible risk** of temporary human health impacts as a result of the proposed trackout activities.

Table 9.7 Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	**Low Risk**
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	**Negligible**

Summary of Dust Emission Risk

The risk of dust impacts as a result of the proposed development are summarised in Table 9.8 for each activity. The magnitude of risk determined is used to prescribe the level of site specific mitigation required for each activity in order to prevent significant impacts occurring.

Overall, in order to ensure that no dust nuisance occurs during the construction and trackout activities, a range of dust mitigation measures associated with a **medium risk** of dust impacts must be implemented. When the dust mitigation measures detailed in Appendix 9.2 are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Table 9.8 Summary of Dust Impact Risk used to Define Site-Specific Mitigation

Potential Impact	Dust Emission Magnitude			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	N/A	N/A	Medium Risk	Low Risk
Human Health	N/A	N/A	Low Risk	Negligible

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions.

Human Health

Construction related dust emissions have the potential to impact human health. As determined above, the likely risk of human health impacts as a result of all relevant construction activities is considered low.

Operational Phase

Air Quality

There is the potential for a number of emissions to the atmosphere during the operational phase of the development. In particular, the traffic-related air emissions may generate quantities of air pollutants such as NO_2, CO, benzene and PM_{10}.

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the development. Road traffic and space heating of buildings may give rise to CO_2 and N_2O emissions.

Human Health

Traffic related air emissions have the potential to impact human health if they do not comply with the ambient Air Quality Standards detailed in Table 9.1.

9.6 DO NOTHING IMPACT

The Do Nothing scenario includes retention of the current site and development of the Rejuvenation Scheme without the proposed residential development in place. The air quality assessment of the Rejuvenation Scheme without the proposed residential extension found that the impact to air quality would be negligible. Therefore, ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from potential new developments in the surrounding area, changes in road traffic, etc).

9.7 AVOIDANCE, REMEDIAL AND MITIGATION MEASURES

Construction Phase

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust.

AQ CONST 1: Air Quality Mitigation Measure
The dust minimisation measures specified in Appendix 9.2 of this chapter will be implemented during the construction phase of the project and thus fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Climate

CO_2 and N_2O emissions during construction will have a negligible impact on climate therefore no mitigation measures are required.

Operational Phase

The impact of the proposed development on air quality and climate will be imperceptible. Thus, no site-specific mitigation measures are required.

9.8 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

Construction Phase

Air Quality

If the dust minimisation measures specified in Appendix 9.2 of this chapter are implemented, fugitive emissions of dust from the site will be ***short-term*** and ***insignificant*** and pose no nuisance at nearby receptors. Construction vehicles, generators etc., will also give rise to some exhaust emissions. However, due to the size and nature of the construction activities, exhaust emissions during construction will have a negligible impact on local air quality. It should be noted that the majority of site works will be undertaken or are currently being undertaken as part of the permitted Rejuvenation Scheme and similar mitigation measures to those proposed in Appendix 9.2 should currently be in place on site to avoid dust nuisance impacts. The proposed residential extension is unlikely to add significantly to on-site dust emissions.

Climate

Due to the small scale of the development the impact on the climate as a result of greenhouse gas emissions is considered to be ***imperceptible*** in the ***long and short term***.

Human Health

Best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active control of dust and other air pollutants to minimise generation of emissions at source. The mitigation measures that will be put in place during construction of the proposed development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values which are based on the protection of human health. Therefore, the impact of construction of the proposed development is likely to be ***short-term*** and ***imperceptible*** with respect to human health.

Operational Phase

The primary impacts to air quality or climate would involve the change in traffic flows or congestion in the local areas which are associated with the development. However, none of the road links impacted by the development satisfy the criteria to complete an air modelling assessment, it can therefore be determined that the impact to air quality and climate from traffic emissions during the operational stage are ***imperceptible*** and ***not significant*** for the long and short term.

In addition, there are no predicted impacts to human health during the operational stage of the development.

Cumulative Impacts

There is the potential for a number of cumulative impacts associated with the proposed residential extension and the previously permitted Rejuvenation Scheme. As the Rejuvenation Scheme is currently at an advanced stage of construction there is the potential for cumulative dust impacts during the construction stage of both projects. However, similar mitigation measures to those proposed in Appendix 9.2 should currently be in place on site to avoid dust nuisance impacts. The proposed residential extension is unlikely to add significantly to on-site dust emissions. Cumulative dust impacts may also occur if the construction phase of the proposed residential extension overlaps with the construction phase of any other development within 350m. The mitigation measures in Appendix 9.2 should avoid any significant off-site dust impacts and if similar mitigation is in place for other sites within 350m then the potential for a temporary cumulative impact is low and not considered significant.

The cumulative impact associated with the operational phase of the proposed residential extension and the permitted Rejuvenation Scheme would be as a result of increased traffic volumes on the nearby road network. As previously mentioned, the proposed residential extension will increase traffic flows on the existing road network by at most 0.5% during peak times and as such the potential impact is considered imperceptible. The impact to air quality as a result of increased traffic flows as a result of the Rejuvenation Scheme was found to be negligible and therefore, the overall cumulative impact associated with both developments is considered ***imperceptible***, ***long-term*** and ***not significant***. The cumulative impact of increased traffic volumes associated with the proposed development in conjunction with other permitted developments in the vicinity of the site was considered in the traffic impact assessment for future opening and design years and the increase was considered imperceptible with regards to air quality. The cumulative impact of the proposed development and any other potential development in future years would be considered under the EIAR for that development.

9.9 MONITORING

In order to ensure that any dust nuisance is minimised, a series of mitigation measures have been listed in Appendix 9.2. If the construction contractor adheres to good working practices and implements dust mitigation measures the levels of dust generated are assessed to be minimal and are unlikely to cause an environmental nuisance.

9.10 REINSTATEMENT

Not Applicable

9.11 INTERACTIONS

Air Quality does not have a significant number of interactions with other parameters. The most important interaction is between air quality and human beings. Interactions between air quality and traffic also have the potential to be significant.

Construction stage dust emissions have the potential to impact human health, however, it was determined that the risk to human health is low for all relevant construction activities. Best practice dust mitigation measures will be implemented on site and as such impacts to human health are predicted to be imperceptible and short-term.

Traffic related emissions have the potential to impact air quality, however, none of the road links impacted by the proposed development satisfied the assessment criteria and it was therefore determined that the impact to air quality is imperceptible for the long and short term.

9.12 DIFFICULTIES ENCOUNTERED IN COMPILING

No difficulties were encountered in the course of this assessment.

9.13 REFERENCES

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(20) UK DEFRA (2017) NO_x to NO_2 Conversion Spreadsheet (Version 6.1)
(21) Transport Infrastructure Ireland (2011) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes
(22) World Health Organisation (2006) Air Quality Guidelines - Global Update 2005 (and previous Air Quality Guideline Reports 1999 & 2000)
(23) The Scottish Office (1996) Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings
(24) UK Office of Deputy Prime Minister (2002) Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance
(25) BRE (2003) Controlling Particles, Vapours & Noise Pollution From Construction Sites
(26) USEPA (1997) Fugitive Dust Technical Information Document for the Best Available Control Measures

(27) USEPA (1986) Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition (periodically updated)

APPENDIX 9.1

Ambient Air Quality Standards

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC) (see Table 9.1). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time which was the issue of acid rain. As a result of this sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. Council Directive 1999/30/EC, as relating to limit values for sulphur dioxide, nitrogen dioxide, lead and particulate matter, is detailed in Table 9.1. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and will start to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has published limit values for both carbon monoxide and benzene in ambient air as set out in Table 9.2. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08 which has been transposed into Irish Law as S.I. 180 of 2011. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. The margins of tolerance specific to each pollutant were also slightly adjusted from previous directives as outlined in Table 9.1. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ is to establish a target value of 25 µg/m^3, as an annual average (to be attained everywhere by 2010) and a limit value of 25 µg/m^3, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 µg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m$^{3)}$. Where the AEI is currently greater than 22 µg/m^3 all appropriate measures should be employed to reduce this level to 18 µg/m^3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 µg/m^3 has been set to be complied with by 2015 again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council

Directive 96/62/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_X (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 21 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

APPENDIX 9.2

Dust Minimisation Plan

The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following management plan has been formulated by drawing on best practice guidance from Ireland, the UK[10,23,24] and BRE[25]and the USA[26].

Site Management
The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies.

At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance (see Figure 9.1 for the windrose for Dublin Airport). As the prevailing wind is predominantly westerly to south-westerly, locating construction compounds and storage piles downwind (to the east) of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors.

Good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or quickly implementing effective control measures before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed[24,25]. The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials[27]. Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods were care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent must monitor the contractors' performance to ensure that the proposed mitigation measures are implemented and that dust impacts and nuisance are minimised;
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board should also include head/regional office contact details;
- It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
- A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;
- It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein;
- At all times, the procedures put in place will be strictly monitored and assessed.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

Site Roads / Haulage Routes

Movement of construction trucks along site roads (particularly unpaved roads) can be a significant source of fugitive dust if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25 to 80%(24).

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads;
- Access gates to the site shall be located at least 10m from sensitive receptors where possible;
- Bowsers or suitable watering equipment will be available during periods of dry weather throughout the construction period. Research has found that watering can reduce dust emissions by 50%(26). Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use;
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

Land Clearing / Earth Moving

Land clearing / earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
- During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

Storage Piles

The location and moisture content of storage piles are important factors which determine their potential for dust emissions.

- Overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site. Where possible storage piles should be located downwind of sensitive receptors;
- Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency(24);
- Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads should be reduced to a minimum by employing the following measures:

- Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;

- At the main site traffic exits, a wheel wash facility shall be installed if feasible. All trucks leaving the site must pass through the wheel wash. In addition, public roads outside the site shall be regularly inspected for cleanliness, as a minimum on a daily basis, and cleaned as necessary.

Monitoring

Monitoring of construction dust deposition at nearby sensitive receptors (residential dwellings) during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m^2*day) during the monitoring period between 28 - 32 days.

Summary of Dust Mitigation Measures

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory performance of the contractor. The key features with respect to control of dust will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;
- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.