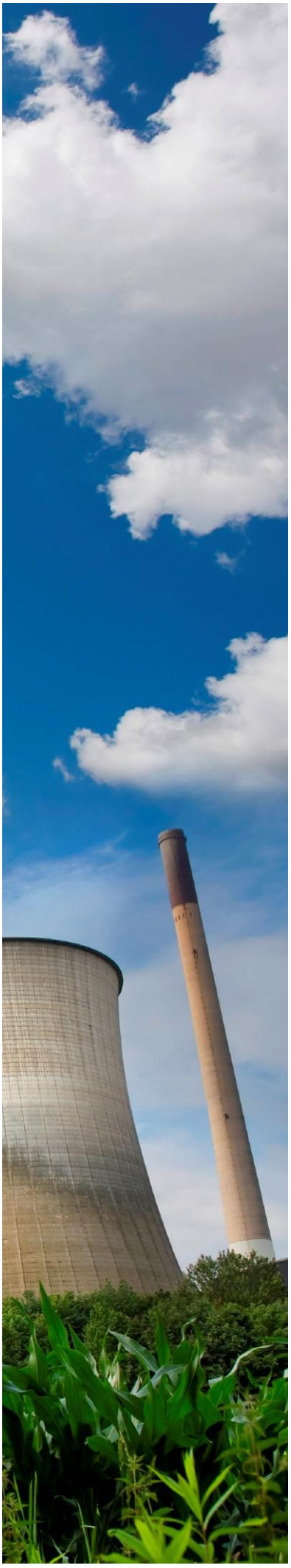
REC
Resource & Environmental Consultants Ltd

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

REC Report: 33666-1r2
Issued: 12th February 2014

Prepared for: MEPC



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REPORT ISSUE

Issue/revision	Issue 1	Revision 2	Revision 3
Remarks	Draft for comment	-	
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EXECUTIVE SUMMARY

Resource and Environmental Consultants Ltd was commissioned by Terence O'Rourke on behalf of MEPC to undertake an Air Quality Assessment in support of the application for a proposed Simplified Planning Zone at Hillington Park, Glasgow.

The proposals comprise the introduction of a Simplified Planning Zone to reduce planning control by removing the requirement for individual applications subject to compliance with defined parameters. Hillington Park is a highly successful Scottish business park providing offices and industrial units to let. At present Hillington Park has in the region of 432,000m^2 of employment land and has planning consent for approximately 53,000m^2 of additional employment land. The proposal at this stage in terms of development, is to increase the level of employment land at the park in the region of 10-15%, including a greater range of ancillary or complementary uses, such as small scale retail and improved leisure facilities.

The Hillington Park Simplified Planning Zone will deregulate the planning process in this area to give greater flexibility for businesses to develop new premises and facilities or adapt existing premises, whilst maintaining a successful and diverse mix of employment generating uses. Development will only be permitted where the local authority is satisfied that it is in accordance with the permitted uses and development parameters set out in the Simplified Planning Zone consent. Development proposals not in accordance with the provisions of the Simplified Planning Zone will be determined by a planning application.

The development site is located within an area identified by Glasgow City Council as experiencing elevated pollutant concentrations. Additionally, the development has the potential to cause air quality impacts at sensitive locations during the construction phase and operational phase. As such, an Air Quality Assessment was required in order to determine baseline conditions and consider potential effects as a result of the development.

Potential construction phase air quality impacts were assessed as a result of fugitive dust emissions. Based on the construction phase assessment results, the following Simplified Planning Zone condition was defined:

> "The potential risk of dust impacts associated with each individual development should be determined as high, medium or low in accordance with the criteria outlined in the following Table.

Construction Dust - Risk Rating

Risk	Criteria
High	• Total site area greater than 10,000m^2 • More than 10 heavy earth moving vehicles active at any one time • More than 100,000 tonnes of material moved • Total building volume greater than 100,000m3 • More than 100 Heavy Duty Vehicle trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m

Risk	Criteria
Medium	• Total site area 2,500m^2 to 10,000m^2 • 5 to 10 heavy earth moving vehicles active at any one time • Total material moved 20,000 tonnes to 100,000 tonnes • Total building volume 25,000m^3 to 100,000m^3 • 25 to 100 Heavy Duty Vehicle trips per day • Unpaved road length 50m to 100m
Low	• Total site area less than 2,500m^2 • Less than 5 heavy earth moving vehicles active at any one time • Total material moved less than 10,000 tonnes • Earthworks during wetter months • Total building volume less than 25,000m^3 • Less than 25 Heavy Duty Vehicle trips per day • Unpaved road length less than 50m

Dependant on the determined dust risk rating, specific mitigation measures to reduce potential impacts should be identified in accordance with the Greater London Authority 'Best Practice Guidance: The Control of Dust and Emissions from Construction and Demolition' document. These should then be implemented throughout the construction phase."

Dispersion modelling was undertaken in order to predict air quality impacts as a result of road vehicle exhaust emissions associated with traffic generated by the development during the operational phase. Results were subsequently verified using monitoring results obtained from Renfrewshire Council.

Impacts on pollutant levels as a result of operational phase vehicle exhaust emissions were not predicted to be significant at any sensitive location in the vicinity of the site. The use of robust assumptions where necessary was considered to provide sufficient confidence in the results for an assessment of this nature. Based on the results of the operational phase assessment, Simplified Planning Zone conditions relating to traffic generated exhaust emissions associated with the development are not considered necessary assuming the measures set out in the Sustainable Transport Strategy are implemented.

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APPENDICES

1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Ltd was commissioned by Terence O'Rourke on behalf of MEPC to undertake an Air Quality Assessment in support a proposed Simplified Planning Zone (SPZ) at Hillington Park, Glasgow.

The proposals comprise introduction of a SPZ to simplify planning control by removing the requirement for individual applications subject to compliance with defined parameters. Hillington Park, which includes an area of land known as Pegasus Land, which is the former Rolls Royce Factory, is located adjacent to junction 26 of the M8. The Park currently provides approximately 432,000m^2 of employment land with approved planning consent for an additional 53,000m^2 of employment land use. The proposal at this stage in terms of development, is to increase the level of employment land at the park in the region of 10-15%, including a greater range of ancillary or complementary uses, such as small scale retail and improved leisure facilities.

Atmospheric emissions associated with any future development have the potential to cause air quality impacts at sensitive receptors. An assessment was therefore undertaken to consider baseline conditions in the vicinity of the site and determine suitable SPZ parameters.

1.2 Site Location and Context

The site is located at Hillington Park, Glasgow, at National Grid Reference (NGR): 251815, 665668. Reference should be made to Figure 1 for a location plan. It should be noted that the development is located within both Glasgow City Council's (GCC) and Renfrewshire Council's (RC) areas of jurisdiction.

One of the stipulations of the SPZ process is that the zones cannot permit any development that would be considered of sufficient significance to require a formal EIA. Previous assessment undertaken by REC (ref: 33666r1) supported the Screening Opinion Request which provided consideration of the potential for EIA development. This assessment and RC's screening opinion concluded an EIA was not necessary and that any air quality impacts can be assessed through a standalone assessment. This is detailed in the following report.

GCC has declared an Air Quality Management Area (AQMA) for particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}) across their entire administrative extent. Some site access roads are located within the AQMA and the proposals therefore have the potential to cause air quality impacts at sensitive receptor locations as a result of emissions associated with both the construction and operational phases. As such, an Air Quality Assessment was required to quantify potential impacts as a result of the proposals and provide consideration of their associated significance.

1.3 Limitations

This report has been produced in accordance with REC's standard terms of engagement. REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2.0 AIR QUALITY LEGISLATION AND POLICY

2.1 European Legislation

European Union (EU) air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidated previous legislation which was designed to deal with specific pollutants in a consistent manner and provided new air quality objectives for particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$). The consolidated Directives include:

- Directive 99/30/EC - the First Air Quality "Daughter" Directive - sets ambient Air Quality Limit Values (AQLVs) for nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), sulphur dioxide, lead and PM_{10};
- Directive 2000/69/EC - the Second Air Quality "Daughter" Directive - sets ambient AQLVs for benzene and carbon monoxide; and,
- Directive 2002/3/EC - the Third Air Quality "Daughter" Directive - seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The fourth daughter Directive was not included within the consolidation and is described as:

- Directive 2004/107/EC - sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.2 Scottish Legislation

Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published in July 2007[1]. The AQS sets out Air Quality Objectives (AQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedences over a specified timescale.

The regulations referred to in the AQS have been implemented by the Air Quality Standards (Scotland) Regulations (2007) and Air Quality Standards (Scotland) Regulations (2010), which transpose the relevant EU Air Quality Directives into Scottish law. AQOs were published in these regulations for six pollutants, in addition to Target Values for an additional five pollutants. Table 1 presents the AQOs for pollutants considered within this assessment.

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	Concentration (µg/m^3)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM_{10}	18	Annual mean
	50	24-hour mean; not to be exceeded more than 7 times a year

2.3 Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves considering present and likely future air quality against the AQOs. If it is predicted that levels at sensitive locations where members of the public are regularly present for the relevant averaging period are likely to be exceeded, the LA is required to declare an AQMA. For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.4 National Planning Policy

Planning Advice Note (PAN) 51: Planning, Environmental Protection and Regulation[2] sets out the Scottish Executive's core policies and principles with respect to environmental aspects of land use planning, including air quality. PAN 51 states that air quality is capable of being a material planning consideration for the following situations where the development is proposed inside, or adjacent to, an AQMA:

- Large scale proposals;
- If they are to be occupied by sensitive groups such as the elderly or young children; or,
- If there is the potential for cumulative effects.

The implications of the PAN 51 have been considered throughout this assessment.

2.5 Glasgow Planning Policy

The Glasgow City Plan 2[3] was formally adopted in 2009 and provides a framework for development within GCC's area of jurisdiction. A review of the Glasgow City Plan 2 indicated the following policy in relation to air quality:

"TRANS 9 - AIR QUALITY

[2] Planning Advice Note PAN 51: Planning, Environmental Protection and Regulation, Scottish Executive, 2006.
[3] Glasgow City Plan 2, Glasgow City Council, 2009.

[…]

Major development proposals (as defined by development guide DG/TRANS 1: Transport Assessments) within or adjacent to the City Centre, Byres Road/Dumbarton Road and Parkhead Cross Air Quality Management Areas (AQMAs), and any subsequent extensions to them or new AQMAs, should consider the likely air quality impacts, in relation to, e.g. the level of projected traffic generation. Where air quality is likely to be an issue, there will be a need to identify suitable mitigation measures, e.g. in relation to the use of new technology/energy efficiency at both the construction and occupation stages (see policy DES 2: Sustainable Design and Construction).

Conditions may be attached to a planning permission for a development if it is likely to affect local air quality. This includes the construction phase.

Full consideration will require to be taken of Planning Advice Note (PAN) 51: Planning, Environmental Protection and Regulation."

This policy has been considered throughout this report.

2.6 Renfrewshire Planning Policy

RC's new Local Development Plan (LDP) is in the process of being prepared and has been submitted to Scottish Government for examination. Until the new LDP comes into force, the Renfrewshire Local Plan (LP)[4] remains in place. The LP was adopted on the 7th March 2006 and is a document that guides development and the use of land within Renfrewshire and sets out policies used to make decisions on planning applications.

A review of the Renfrewshire LP indicated the following policy in relation to air quality:

"Policy T1: Policy on the Assessment of New Developments.

Criteria for assessment

The Council will assess development proposals against its approved Roads Development Guidelines and will, where it considers it to be necessary, require the submission of a Transport Assessment. The Council it will also assess development proposals against the principles, policies and guidance set out in the Structure Plan, NPPG 17 and PAN 57. Matters arising from these documents are summarised below and there will be a presumption that development proposals will require to fulfil these criteria to the satisfaction of the Council. However it is not the intention of the Council to apply each and all of the criteria to developments which will have an insignificant effect on transport. In determining the application of the criteria the Council will therefore take account of the nature, scale and location of the development proposal and its likely significance for sustainable transport matters.

[…]

Environmental Impact

[4] Renfrewshire Local Plan, Renfrewshire Council, 2006.

(viii) Environmental Impact of Traffic and Transport Infrastructure.

- The individual and cumulative impact of the traffic generated by the development on air quality is acceptable to the Council."

This policy has been considered throughout this assessment by considering impacts of traffic generated by the proposed development on nearby sensitive receptors.

A review RC's new LDP[5] indicated that there are no policies relating to air quality at the time of this assessment.

[5] Renfrewshire Local Development Plan - Proposed Plan, Renfrewshire Council, 2013.

3.0 METHODOLOGY

The proposed development has the potential to cause air quality impacts during the construction and operational phases. These have been assessed in accordance with the following methodology which was agreed with Dom Callaghan, Technical Officer of Environment and Strategy in the Land and Environmental Services department at GCC on 16th October 2013. Reference has been made to the GCC document 'Air Quality and Planning Guidance' where necessary.

3.1 Construction Phase Assessment

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. The significance of effects will depend on the scale and nature of the individual developments covered by the SPZ, as well as the distance to sensitive receptor locations. An overarching assessment using the principles of the methodology outlined within the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance'[6] has therefore been undertaken in order to define suitable parameters for inclusion within the SPZ.

3.2 Operational Phase Assessment

The development has the potential to impact on existing air quality as a result of road traffic exhaust emissions, such as NO_2 and PM_{10}, associated with vehicles travelling to and from the site. Potential impacts have been defined by predicting pollutant concentrations at sensitive locations through dispersion modelling for the following scenarios:

- 2012 Verification;
- 2024 do-minimum (DM) (predicted traffic flows should the development not proceed);
- 2024 do-something (DS) (predicted traffic flows should the development be completed); and,
- 2024 DS (predicted traffic flows should the development be completed) plus mitigation.

Reference should be made to Appendix II for assessment input data.

Receptors potentially sensitive to operational traffic exhaust emissions were identified within 200m of the affected highway network in accordance with the guidance provided within the Design Manual for Roads and Bridges (DMRB)[7] on the likely limits of pollutant dispersion from road sources. LAQM.TG(09)[8] provides the following examples of where annual mean AQOs should apply:

- Residential properties;
- Schools;
- Hospitals; and,
- Care homes.

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6 Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance, Institute of Air Quality Management, 2011.
7 Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.
8 Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

These were considered during the selection of receptor locations.

The significance of potential impacts was assessed by calculating the predicted change in NO_2 and PM_{10} concentrations at sensitive locations as a result of the proposed development. This was then compared with the guidance contained within the Environmental Protection UK (EPUK) Development Control: Planning for Air Quality (2010 update)[9] document. The method for defining the magnitude of impact is outlined in Table 2.

Table 2 Magnitude of Change

Magnitude of Change	Change in Pollutant Level as Proportion of Assessment Criteria (%)
Large	Greater than 10
Medium	5 - 10
Small	1 - 5
Imperceptible	Less than 1

Impact significance was defined based on the magnitude of change and predicted NO_2 and PM_{10} concentrations during the operation of the development, as summarised in Table 3.

Table 3 Significance of Impact

Predicted Concentration	Magnitude of Change			
	Imperceptible	Small	Medium	Large
• NO_2 annual mean greater than 40µg/m^3 • PM_{10} annual mean greater than 18µg/m^3	Negligible	Slight	Moderate	Substantial
• NO_2 annual mean 36 - 40µg/m^3 • PM_{10} annual mean 16 - 18µg/m^3	Negligible	Slight	Moderate	Moderate
• NO_2 annual mean 30 - 36µg/m^3 • PM_{10} annual mean 14 - 16µg/m^3	Negligible	Negligible	Slight	Slight
• NO_2 annual mean below 30µg/m^3 • PM_{10} annual mean below 14µg/m^3	Negligible	Negligible	Negligible	Slight

Following the prediction of impacts at sensitive receptor locations, the EPUK[10] document

[9] Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010.
[10] Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010.

provides guidance on determining the overall air quality impact significance of the operation of a development. The following factors are identified for consideration by the assessor:

- Number of properties affected by significant air quality impacts and a judgement on the overall balance;
- Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant;
- The magnitude of changes and the descriptions of the impacts at the receptors;
- Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased;
- Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced; and,
- The extent to which an objective or limit value is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3.

These factors were considered and an overall significance determined for the impact of the development. It should be noted that the determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts. The guidance suggests the provision of details of the assessor's qualifications and experience. These are provided in Appendix II.

4.0 BASELINE

Existing air quality conditions in the vicinity of the proposed development site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

4.1 Local Air Quality Management

As required by the Environment Act (1995), RC and GCC have undertaken Review and Assessment of air quality within their areas of jurisdiction. This process has indicated that concentrations of NO_2 and PM_{10} are above the AQOs within RC's and GCC's extents. As such, a number of AQMAs have been declared. The nearest to the development are described as:

> "Glasgow - City-Wide AQMA";

And:

> "Paisley AQMA - An area encompassing a large part of central Paisley and extending a short distance along some radial roads".

The Glasgow AQMA was declared for exceedences of the annual mean and 24-hour mean PM_{10} AQOs. The proposed development is located partially within the AQMA. As such, any emissions associated with the scheme to impact on this sensitive area. This has been considered within this report.

The Paisley AQMA was declared for exceedences of the 1-hour and annual mean NO_2 AQOs and the annual mean PM_{10} AQO. It is situated approximately 4km from the proposals. Due to the distance between the sites, potential impacts on pollutant concentrations within the AQMA are not anticipated to be significant and they have not been considered further in the context of this assessment.

GCC and RC have concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs and as such no further AQMAs have been designated.

4.2 Air Quality Monitoring

Monitoring of pollutant concentrations is undertaken by GCC and RC using continuous and periodic methods throughout their areas of jurisdiction. A review of the most recent LAQM reports[11,12] indicated that no continuous monitoring is undertaken in the vicinity of the site.

GCC and RC utilise passive diffusion tubes to monitor NO_2 concentrations. There are a number of sites located in the vicinity of the proposed development and recent monitoring results are shown in Table 4, exceedences are highlighted in **bold**.

[11] 2013 Air Quality Progress Report for Glasgow City Council, Glasgow City Council, 2013.
[12] 2013 Air Quality Progress Report for Renfrewshire Council, Renfrewshire Council, 2013.

Table 4 NO_2 Diffusion Tube Monitoring Results

Site Name/ Number	Location	Annual Mean Concentration (µg/m^3)		
		2010	2011	2012
Renfrew 17	Tanar Way, Renfrew	**42.4**	**41.9**	37.3
Renfrew 23	Hillington Road, Renfrew	35.2	35.5	29.5
Renfrew 24	Glasgow Road, Renfrew	30.5	26.9	26.7
Renfrew 48	Glen Sax Drive, Renfrew	38.0	**40.6**	35.7
Renfrew 49	Tanar Way 2, Renfrew	36.0	36.5	33.6
Renfrew 52	Glasgow Road 2, Renfrew	35.7	38.0	35.8
Mallaig Place	Mallaig Place, Glasgow	29.0	23.0	19.0

As indicated in Table 4 the annual mean AQO for NO_2 was exceeded in recent years at diffusion tubes Renfrew 17 and Renfrew 48. However, these sites are located in close proximity to the M8 motorway and are therefore significantly affected by road vehicle exhaust emissions.

Reference should be made to Figure 2 for a map of diffusion tube locations.

Monitoring of PM_{10} concentrations is not currently undertaken in the vicinity of the proposed development.

4.3 Background Pollutant Concentrations

Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The development is located within nine grid squares. Data for these locations were downloaded from the DEFRA website[13] for the purpose of this assessment and is summarised in Table 5.

Table 5 Predicted Background Pollutant Concentrations

Grid Square (NGR)	Predicted 2013 Background Concentration (µg/m^3)		
	NO_x	NO_2	PM_{10}
250500, 664500	24.56	16.82	12.29
251500, 664500	24.93	17.02	12.70
252500, 664500	27.54	18.57	13.56
250500, 665500	28.66	19.27	13.99
251500, 665500	40.92	25.23	15.99

[13] http://laqm.defra.gov.uk/maps/maps2010.html.

Grid Square (NGR)	Predicted 2013 Background Concentration (µg/m^3)		
	NO_x	NO_2	PM_{10}
252500, 665500	40.04	25.00	15.71
250500, 666500	26.96	18.25	13.72
251500, 666500	36.13	23.29	15.46
252500, 666500	46.64	27.90	15.45

As indicated in Table 5, background pollutant concentrations were predicted to be below the relevant AQOs in 2013. Comparison with the diffusion tube monitoring results shows the significant influence of emissions from the surrounding highway network on ambient concentrations.

4.4 Sensitive Receptors

A sensitive receptor is defined as any location which may be affected by changes in air quality as a result of a development. These have been defined for dust and road vehicle exhaust emission impacts in the following Sections.

4.4.1 Construction Phase Sensitive Receptors

Receptors sensitive to potential dust impacts during earthworks and construction were identified from a desk-top study of the area up to 350m from the site boundary. This indicated residential properties to the south on Linburn Road. Hillington Park itself is commercial in nature and as such would not be considered sensitive to dust impacts.

Reference should be made to Figure 3 for a graphical representation of potential dust residential receptor locations.

The sensitivity of the receiving environment to dust emissions was determined based on the IAQM guidance[14], as summarised in Table 6.

[14] Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance, Institute of Air Quality Management, 2012.

Table 6 Construction Dust - Receptor Sensitivity

Sensitivity	Examples	
	Human Receptors	**Ecological Receptors**
Very high	• Very densely populated area • More than 100 dwellings within 20m • Local PM_{10} concentrations exceed the AQO • 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 to 100 dwellings within 20m of site • Local PM_{10} concentrations close to the AQO (e.g. annual mean 16 - 18µg/m^3) • Commercially sensitive horticultural land within 20m	• Nationally designated site
Medium	• Suburban or edge of town area • Less than 10 receptors within 20m • Local PM_{10} concentrations below the AQO (e.g. annual mean 14 - 16µg/m^3)	• Locally designated site
Low	• Rural or industrial area • No receptors within 20m • Local PM_{10} concentrations well below the AQO (less than 14µg/m^3) • Wooded area between site and receptors	• No designations

Based on the criteria shown in Table 6 the sensitivity of the receiving environment to potential dust impacts was considered to be **medium**. This was because the site is situated in an out of town location, predicted background PM_{10} concentrations are below the AQO and there are no ecological designations within the assessment area.

4.4.2 Operational Phase Sensitive Receptors

Receptors sensitive to potential operational phase impacts were identified from a desk-top study and are summarised in Table 7.

Table 7 Road Vehicle Exhaust Emission Sensitive Receptors

Receptor		NGR (m)	
		X	**Y**
R1	Residential - Cairn Avenue	251077	666142
R2	Residential - Tanar Avenue	251542	666288
R3	Residential - Tirry Avenue	251858	666630

Receptor		NGR (m)	
		X	Y
R4	Residential - Torridon Drive	251526	666935
R5	Residential - Penilee Road opposite Balfron Road	251110	664327
R6	Residential - Hillington Quad	252195	664255
R7	Our Lady and Saint George	252205	664113
R8	Residential - Penneld Road	252130	664113
R9	Residential - Linburn Place	252048	664964
R10	Residential - Penilee Terrace	251088	665114
R11	Residential - Penilee Road north of Dunchurch Road	251074	664252

The sensitive receptors identified in Table 7 represent worst-case locations. However, this is not an exhaustive list and there may be other locations within the vicinity of the site that may experience air quality impacts as a result of the proposed development that have not been individually identified above. Reference should be made to Figure 4 for a graphical representation of road vehicle exhaust emission sensitive receptor locations.

5.0 IMPACT ASSESSMENT

There is the potential for air quality impacts as a result of the construction and operation of the proposed development. These are assessed in the following Sections.

5.1 Construction Phase Assessment

The undertaking of activities such as excavation, ground works, cutting, construction, concrete batching and storage of materials has the potential to result in fugitive dust emissions throughout the construction phase of any development. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul road and highway surfaces.

The potential for impacts at sensitive locations depends significantly on local meteorology during the undertaking of dust generating activities, with the most significant effects likely to occur during dry and windy conditions.

The desk-study undertaken to inform the baseline identified sensitive receptors to the south of the site on Linburn Road and defined the receiving environment as **medium** sensitivity.

The significance of air quality impacts associated with fugitive dust emissions during the construction phase will depend on the scale and nature of each individual development permitted under the SPZ. In order to protect residents it is proposed that each proposal is defined as a **low**, **medium** or **high** risk site, in accordance with the criteria outlined in Table 8, which has been adapted from the IAQM[15] guidance.

Table 8 Construction Dust - Risk Rating

Risk	Criteria
High	• Total site area greater than 10,000m^2 • More than 10 heavy earth moving vehicles active at any one time • More than 100,000 tonnes of material moved • Total building volume greater than 100,000m^3 • More than 100 Heavy Duty Vehicle (HDV) trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	• Total site area 2,500m^2 to 10,000m^2 • 5 to 10 heavy earth moving vehicles active at any one time • Total material moved 20,000 tonnes to 100,000 tonnes • Total building volume 25,000m^3 to 100,000m^3 • 25 to 100 HDV trips per day • Unpaved road length 50m to 100m

[15] Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance, Institute of Air Quality Management, 2011.

Risk	Criteria
Low	• Total site area less than 2,500m^2 • Less than 5 heavy earth moving vehicles active at any one time • Total material moved less than 10,000 tonnes • Earthworks during wetter months • Total building volume less than 25,000m^3 • Less than 25 HDV trips per day • Unpaved road length less than 50m

Dependent on the determined dust risk rating of the development site, specific mitigation measures to reduce potential dust impacts should be identified in accordance with the Greater London Authority 'Best Practice Guidance: The Control of Dust and Emissions from Construction and Demolition'[16]. This provides suitable control measures for **low**, **medium** or **high** risk sites and is considered to represent best practice measures for the mitigation of construction dust impacts.

Based on the implementation of the relevant mitigation measures, the residual significance of potential impacts from dust generating activities associated with any future development is considered to be **negligible** at all sensitive receptor locations in the vicinity of the site.

5.2 Operational Phase Assessment

Additional vehicle movements associated with the operation of the proposed development will generate exhaust emissions on the local road networks. An assessment was therefore undertaken using dispersion modelling in order to quantify potential changes in pollutant concentrations at sensitive locations in the vicinity of the development.

The assessment considered the following scenarios:

- 2012 - Verification;
- 2024 - Do-Minimum (DM);
- 2024 - Do-Something (DS); and,
- 2024 - DS + Mitigation.

The "DM" (i.e. without development) scenario was representative of baseline traffic data for the opening year excluding employment from the Former Rolls Royce Land. The "DS" (i.e. with development) scenario was representative of baseline traffic data for the opening year excluding employment from the Former Rolls Royce Land but including vehicle trips associated with the SPZ. The "DS + Mitigation" scenario was representative of baseline traffic data for the opening year excluding employment from the Former Rolls Royce Land but including vehicle trips associated with the proposal and the implementation of mitigation.

Mitigation measures are inherent in the development proposals and will be applied through a Sustainable Transport Strategy which has been produced by Vectos, the transport consultants for the project. This includes a number of initiatives to reduce potential impacts from traffic associated with the development. The Strategy considers the implementation of

[16] Best Practice Guidance: Control of Dust and Emissions from Construction and Demolition, Greater London Authority, 2006.

the following:

- Walk and Cycling Routes;
- Cycle Hire;
- Electric Covered Buses/Cycles;
- Demand responsive vehicles (electric);
- Awareness and Education;
- Travel Planning and Management; and,
- The Hub - a social centre, a transport node, a place to meet, to exercise, to wait and to conduct business.

Implementing the above measures may result in fewer vehicle trips and, therefore, a reduction in pollution levels. This has been taken into account in the "DS + Mitigation" scenario.

Reference should be made to Appendix II for full assessment input details.

5.2.1 Nitrogen Dioxide

Annual mean NO_2 concentrations were predicted for each scenario and are summarised in Table 9. The DM scenario has been compared to both the DS scenario and the DS + Mitigation scenario in order to assess impacts with and without mitigation. Exceedences of the annual mean AQO of 40µg/m^3 are highlighted in **bold**.

Reference should be made to Figure 5 to Figure 7 for graphical representations of predicted NO_2 levels throughout the assessment extents.

Table 9 Predicted Annual Mean NO_2 Concentrations

Sensitive Receptor	Predicted Annual Mean NO_2 Concentration (µg/m^3)					
	DM	DS	Change	DM	DS + Mitigation	Change
R1	**44.83**	**45.00**	0.17	**44.83**	**44.92**	0.09
R2	**45.76**	**45.97**	0.21	**45.76**	**45.87**	0.11
R3	33.71	33.79	0.08	33.71	33.73	0.02
R4	33.47	33.55	0.08	33.47	33.49	0.02
R5	31.54	31.66	0.12	31.54	31.46	-0.08
R6	35.04	35.29	0.25	35.04	35.16	0.12
R7	31.14	31.23	0.09	31.14	31.18	0.04
R8	32.73	32.90	0.17	32.73	32.81	0.08
R9	31.61	31.71	0.10	31.61	31.65	0.04
R10	31.69	31.81	0.12	31.69	31.63	-0.06
R11	30.92	31.01	0.09	30.92	30.86	-0.06

As indicated in Table 9, predicted concentrations were below the relevant AQO at all sensitive receptors, with the exception of R1 and R2 where exceedences were predicted for all scenarios. It should be noted that there are no new predicted exceedences of the annual mean AQO for NO_2 as a result of the SPZ.

Decreases in annual mean NO_2 concentrations were predicted at R5, R10 and R11 with the implementation of mitigation in the form of a Sustainable Transport Strategy. This is a result of the proposed measures reducing traffic flows on road links close to the receptor locations.

Predicted impacts on annual mean NO_2 concentrations at the sensitive receptor locations are summarised in Table 10. These are based on the criteria outlined in the EPUK Development Control: Planning for Air Quality (2010 update)[17] document.

Table 10 Predicted NO_2 Impacts

Receptor	DM and DS Scenarios			DM and DS + Mitigation Scenarios		
	Magnitude of Change	Predicted Conc.	Significance of Impact	Magnitude of Change	Predicted Conc.	Significance of Impact
R1	Imperceptible	Annual mean greater than 40µg/m^3	Negligible	Imperceptible	Annual mean greater than 40µg/m^3	Negligible
R2	Imperceptible	Annual mean greater than 40µg/m^3	Negligible	Imperceptible	Annual mean greater than 40µg/m^3	Negligible
R3	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible
R4	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible
R5	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible
R6	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible
R7	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible
R8	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible
R9	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible
R10	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible
R11	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible	Imperceptible	Annual mean 30 - 36µg/m^3	Negligible

[17] Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010.

As indicated in Table 10, impacts on annual mean NO_2 concentrations as a result of the SPZ were predicted to be **negligible** at all locations both with and without the implementation of mitigation measures.

5.2.2 Predicted Concentrations - Particulate Matter

Annual mean PM_{10} concentrations were predicted for each scenario and are summarised in Table 11. The DM scenario has been compared to both the DS scenario and the DS + Mitigation scenario in order to assess impacts with and without mitigation.

Reference should be made to Figure 8 to Figure 10 for graphical representations of predicted PM_{10} levels throughout the assessment extents.

Table 11 Predicted Annual Mean PM_{10} Concentrations

Sensitive Receptor	Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)					
	DM	DS	Change	DM	DS + Mitigation	Change
R1	17.67	17.70	0.02	17.67	17.68	0.01
R2	17.82	17.85	0.03	17.82	17.84	0.01
R3	16.44	16.45	0.01	16.44	16.44	0.00
R4	16.48	16.49	0.01	16.48	16.47	-0.00
R5	16.17	16.19	0.02	16.17	16.14	-0.03
R6	16.78	16.83	0.04	16.78	16.79	0.01
R7	16.06	16.08	0.01	16.06	16.07	0.00
R8	16.36	16.39	0.03	16.36	16.37	0.01
R9	16.11	16.13	0.02	16.11	16.11	0.00
R10	16.16	16.18	0.02	16.16	16.14	-0.02
R11	16.05	16.06	0.01	16.05	16.03	-0.02

As indicated in Table 11, predicted concentrations were below the relevant AQO of $18\mu g/m^3$ at all sensitive receptors for all scenarios considered.

Similarly to NO_2, decreases in annual mean PM_{10} concentrations were predicted at R5, R10 and R11 with the implementation of mitigation in the form of a Sustainable Transport Strategy. This is a result of the proposed measures reducing traffic flows on the road links close to the receptor locations.

Predicted impacts on annual mean PM_{10} concentrations at the sensitive receptor locations are summarised in Table 12. These are based on the criteria outlined in the EPUK Development Control: Planning for Air Quality (2010 update)[18] document.

[18] Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010.

Table 12 Predicted PM_{10} Impacts

Receptor	DM and DS Scenarios			DM and DS + Mitigation Scenarios		
	Magnitude of Change	**Predicted Conc.**	**Significance of Impact**	**Magnitude of Change**	**Predicted Conc.**	**Significance of Impact**
R1	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R2	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R3	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R4	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R5	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R6	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R7	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R8	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R9	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R10	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible
R11	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible	Imperceptible	Annual mean 16 - 18µg/m^3	Negligible

As indicated in Table 12, impacts on annual mean PM_{10} concentrations as a result of the SPZ were predicted to be **negligible** at all locations both with and without the implementation of mitigation measures.

5.2.3 Overall Impact Significance

The overall significance of potential impacts associated with the development was determined as **negligible**. Further justification is provided in Table 13.

Table 13 Overall Road Traffic Exhaust Emission Impact Significance

Guidance	Comment
Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance	Air quality impacts were predicted to be negligible at all receptors. These represent worst-case locations and therefore it is unlikely that any other sensitive locations will be affected by the proposed development
Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant	The proposed development does not include any sensitive land use
The magnitude of changes and the descriptions of the impacts at the receptors	The magnitude of change in pollutant concentrations was imperceptible at all sensitive receptor locations. As such, the resultant significance was negligible
Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased	Exceedences of the annual mean AQO for NO_2 were predicted at sensitive locations in all scenarios within the study area both with and without the development. There were no new exceedences as a result of the development. No exceedence of the PM_{10} AQO was predicted in any scenario
Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced	Exceedences of the annual mean AQO for NO_2 were predicted at sensitive locations in all scenarios. There were no exceedence removals as a result of the development. No exceedence of the PM_{10} AQO was predicted in any scenario. It is not considered that the area of exceedence will be reduced as a result of the proposals
The extent to which an objective or limit value is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3	Exceedences of the annual mean AQO for NO_2 were predicted at R1 and R2 for all scenarios considered. However, the significance of impact at these receptors was negligible and therefore the magnitude of concentration was not considered relevant to the assessment. No exceedence of the PM_{10} AQO was predicted in any scenario

6.0 SIMPLIFIED PLANNING ZONE CONDITIONS

6.1 Construction Phase

Based on the assessment results, the following SPZ condition is proposed to control potential construction phase dust impacts:

"The potential risk of dust impacts associated with each individual development should be determined as high, medium or low in accordance with the criteria outlined in the following Table.

Construction Dust - Risk Rating

Risk	Criteria
High	• Total site area greater than 10,000m^2 • More than 10 heavy earth moving vehicles active at any one time • More than 100,000 tonnes of material moved • Total building volume greater than 100,000m3 • More than 100 Heavy Duty Vehicle trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	• Total site area 2,500m^2 to 10,000m^2 • 5 to 10 heavy earth moving vehicles active at any one time • Total material moved 20,000 tonnes to 100,000 tonnes • Total building volume 25,000m^3 to 100,000m^3 • 25 to 100 Heavy Duty Vehicle trips per day • Unpaved road length 50m to 100m
Low	• Total site area less than 2,500m^2 • Less than 5 heavy earth moving vehicles active at any one time • Total material moved less than 10,000 tonnes • Earthworks during wetter months • Total building volume less than 25,000m^3 • Less than 25 Heavy Duty Vehicle trips per day • Unpaved road length less than 50m

Dependant on the determined dust risk rating, specific mitigation measures to reduce potential impacts should be identified in accordance with the Greater London Authority 'Best Practice Guidance: The Control of Dust and Emissions from Construction and Demolition' document. These should then be implemented throughout the construction phase."

6.2 Operational Phase

The results of the dispersion modelling assessment indicated that impacts on pollutant levels as a result of operational phase vehicle exhaust emissions were not predicted to be significant at any sensitive location in the vicinity of the site. The use of robust assumptions where necessary was considered to provide sufficient confidence in the results for an

assessment of this nature. Based on the results of the operational phase assessment, SPZ conditions relating to traffic exhaust emissions generated by the development are not considered necessary assuming the measures set out in the Sustainable Transport Strategy are implemented.

7.0 CONCLUSION

REC Ltd was commissioned by Terence O'Rourke on behalf of MEPC to undertake an Air Quality Assessment in support of the planning application for a proposed SPZ at Hillington Park, Glasgow.

The proposals comprise the introduction of a SPZ to simplify planning control by removing the requirement for individual applications subject to compliance with defined parameters. The Hillington Park SPZ will deregulate the planning process in this area to give greater flexibility for businesses to develop new premises and facilities or adapt existing premises, whilst maintaining a successful and diverse mix of employment generating uses. Development will only be permitted where the local authority is satisfied that it is in accordance with the permitted uses and development parameters set out in the SPZ. Development proposals not in accordance with the provisions of the SPZ will be determined by a planning application.

The development site is located within an area identified by GCC as experiencing elevated pollutant concentrations. Additionally, the development has the potential to cause air quality impacts at sensitive locations during the construction phase and operational phase. As such, an Air Quality Assessment was required in order to determine baseline conditions and consider potential effects as a result of the development.

Potential construction phase air quality impacts were assessed as a result of fugitive dust emissions. Based on the assessment results, the following condition was defined for inclusion within the SPZ consent:

> "The potential risk of dust impacts associated with each individual development should be determined as high, medium or low in accordance with the criteria outlined in the following Table.

Construction Dust - Risk Rating

Risk	Criteria
High	• Total site area greater than 10,000m^2 • More than 10 heavy earth moving vehicles active at any one time • More than 100,000 tonnes of material moved • Total building volume greater than 100,000m3 • More than 100 Heavy Duty Vehicle trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	• Total site area 2,500m^2 to 10,000m^2 • 5 to 10 heavy earth moving vehicles active at any one time • Total material moved 20,000 tonnes to 100,000 tonnes • Total building volume 25,000m^3 to 100,000m^3 • 25 to 100 Heavy Duty Vehicle trips per day • Unpaved road length 50m to 100m

Risk	Criteria
Low	• Total site area less than 2,500m^2 • Less than 5 heavy earth moving vehicles active at any one time • Total material moved less than 10,000 tonnes • Earthworks during wetter months • Total building volume less than 25,000m^3 • Less than 25 Heavy Duty Vehicle trips per day • Unpaved road length less than 50m

Dependant on the determined dust risk rating, specific mitigation measures to reduce potential impacts should be identified in accordance with the Greater London Authority 'Best Practice Guidance: The Control of Dust and Emissions from Construction and Demolition' document. These should then be implemented throughout the construction phase."

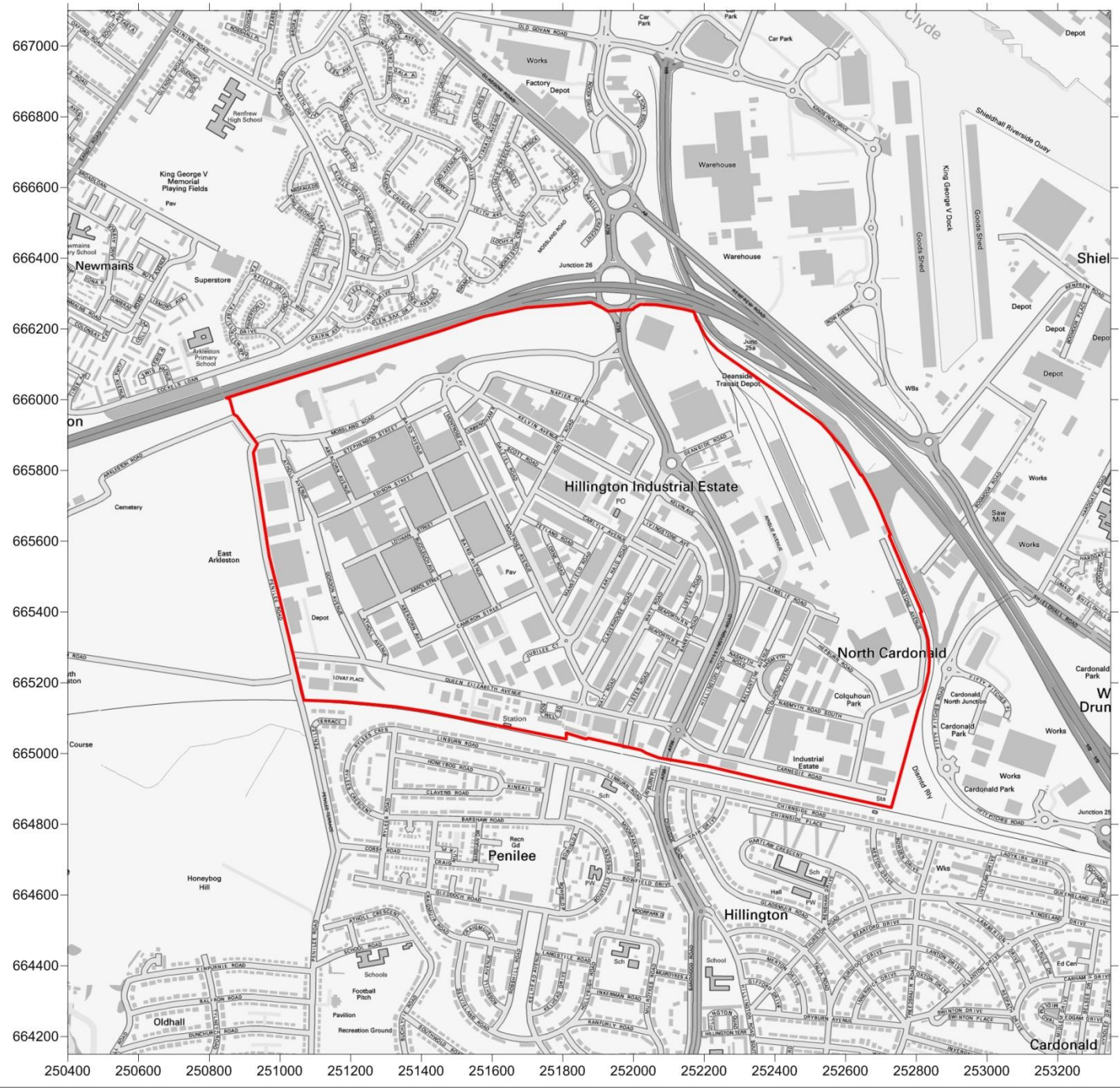
Dispersion modelling was undertaken in order to predict air quality impacts as a result of road vehicle exhaust emissions associated with traffic generated by the development during the operational phase. Results were subsequently verified using monitoring results obtained from RC.

Impacts on pollutant levels as a result of operational phase vehicle exhaust emissions were not predicted to be significant at any sensitive location in the vicinity of the site. The use of robust assumptions where necessary was considered to provide sufficient confidence in the results for an assessment of this nature. Based on the results of the operational phase assessment, SPZ conditions relating to traffic exhaust emissions generated by the development are not considered necessary assuming the measures set out in the Sustainable Transport Strategy are implemented.

8.0 ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQAP	Air Quality Action Plan
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DM	Do-minimum
DMRB	Design Manual for Roads and Bridges
DS	Do-something
EIA	Environmental Impact Assessment
EPUK	Environmental Protection UK
EU	European Union
GCC	Glasgow City Council
HDV	Heavy Duty Vehicle
LA	Local Authority
LAQM	Local Air Quality Management
LDP	Local Development Plan
LP	Local Plan
NGR	National Grid Reference
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
PAN	Planning Advice Note
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10µm
REC	Resource and Environmental Consultants
RC	Renfrewshire Council
SPZ	Simplified Planning Zone
z_0	Roughness Length

APPENDIX I FIGURES



Legend

Site Boundary

Title

Figure 1 - Site Location

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

Project Number

33666

Client

MEPC

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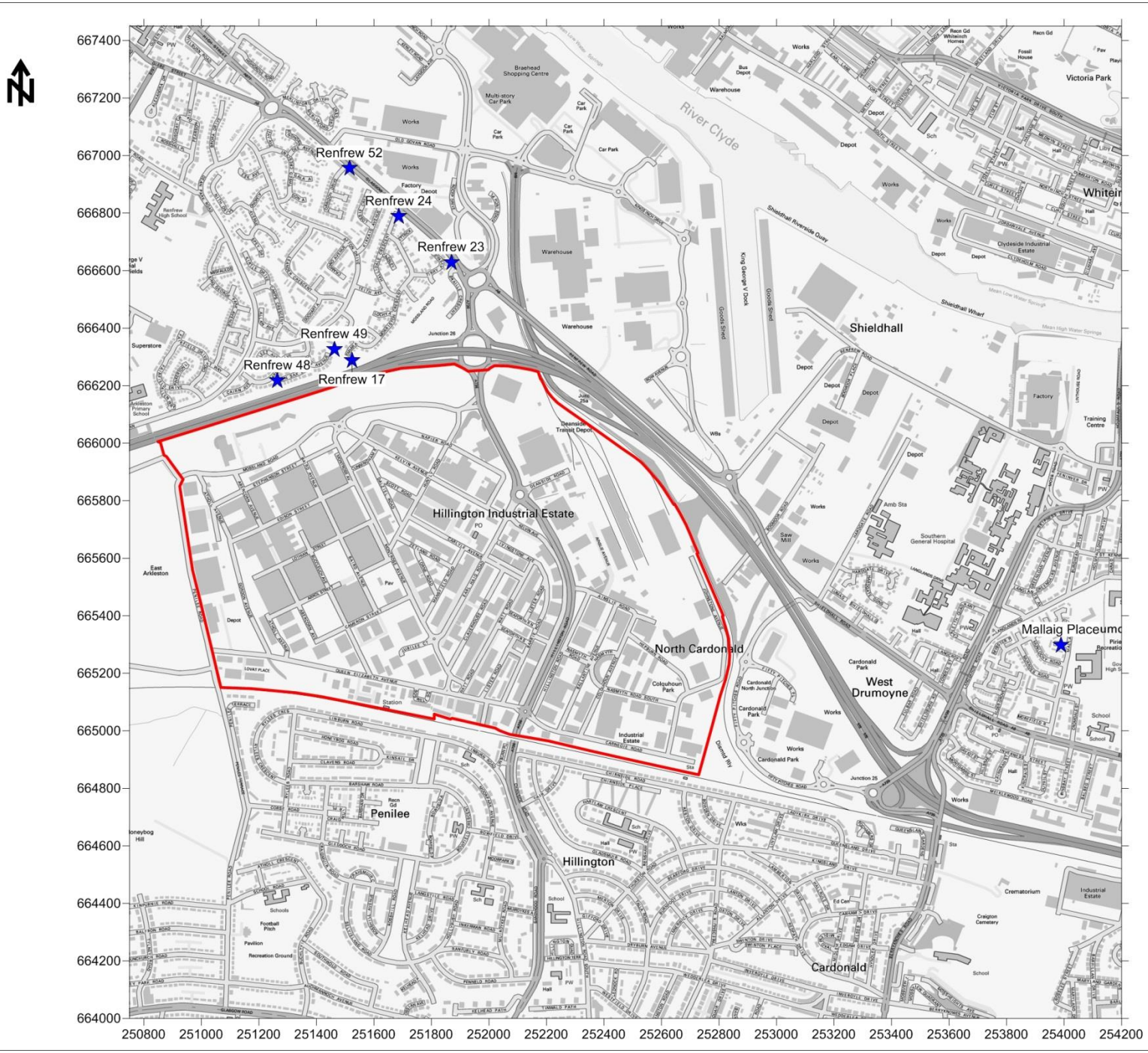

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Site Boundary

Diffusion Tubes

Title

Figure 2 - Diffusion Tube Monitoring Locations

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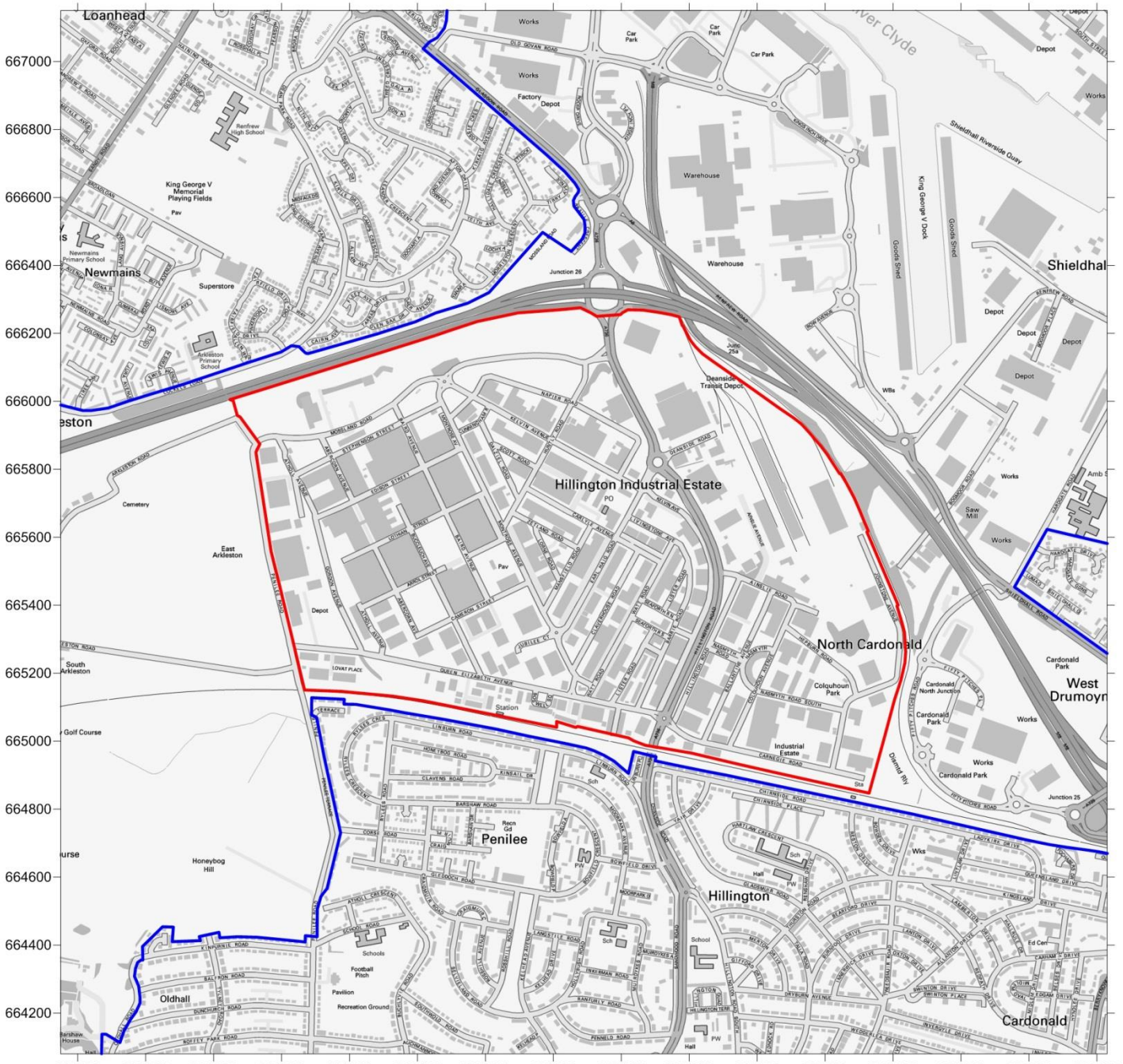

Legend

Site Boundary

Residential Area

Title

Figure 3 - Residential Sensitive Receptor Areas

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Site Boundary

Senstive Receptor

Title

Figure 4 - Road Vehicle Exhaust Emission Sensitive Receptors

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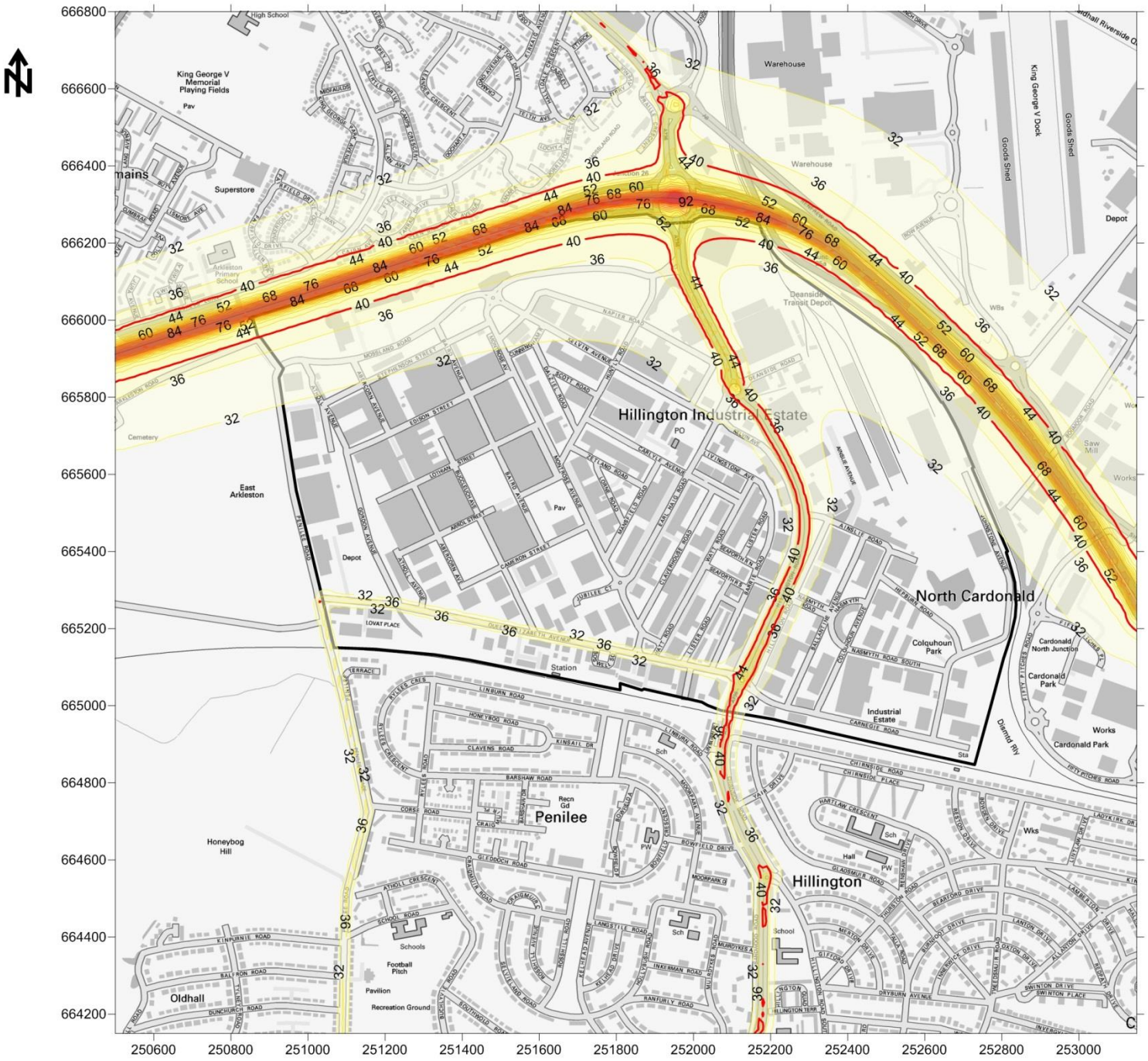

Legend

Site Boundary

92
88
84
80
76
72
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64
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56
52
48
44
40
36
32

Predicted Annual Mean NO2 Concentration (µg/m3)

Title

Figure 5 - Predicted Annual Mean NO2 Concentration (µg/m3)
Do-Minimum

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

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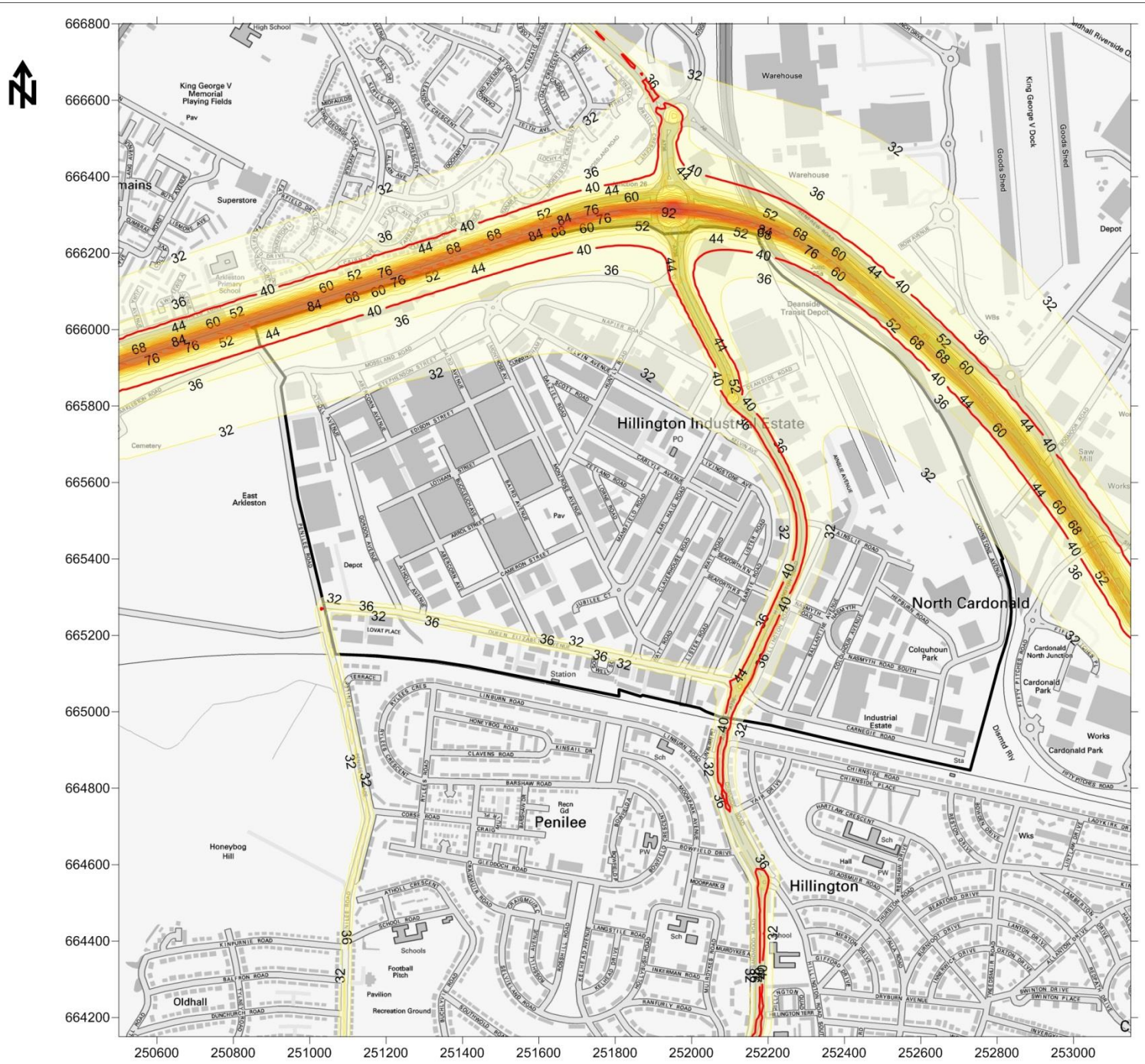

Legend

Site Boundary

96
92
88
84
80
76
72
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64
60
56
52
48
44
40
36
32

Predicted Annual Mean NO2 Concentration (µg/m3)

Title

Figure 6 - Predicted Annual Mean NO2 Concentration (µg/m3)
Do-Something

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

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Legend

Site Boundary

96
92
88
84
80
76
72
68
64
60
56
52
48
44
40
36
32

Predicted Annual Mean NO2 Concentration (µg/m3)

Title

Figure 7 - Predicted Annual Mean NO2 Concentration (µg/m3)
Do-Something + Mitigation

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

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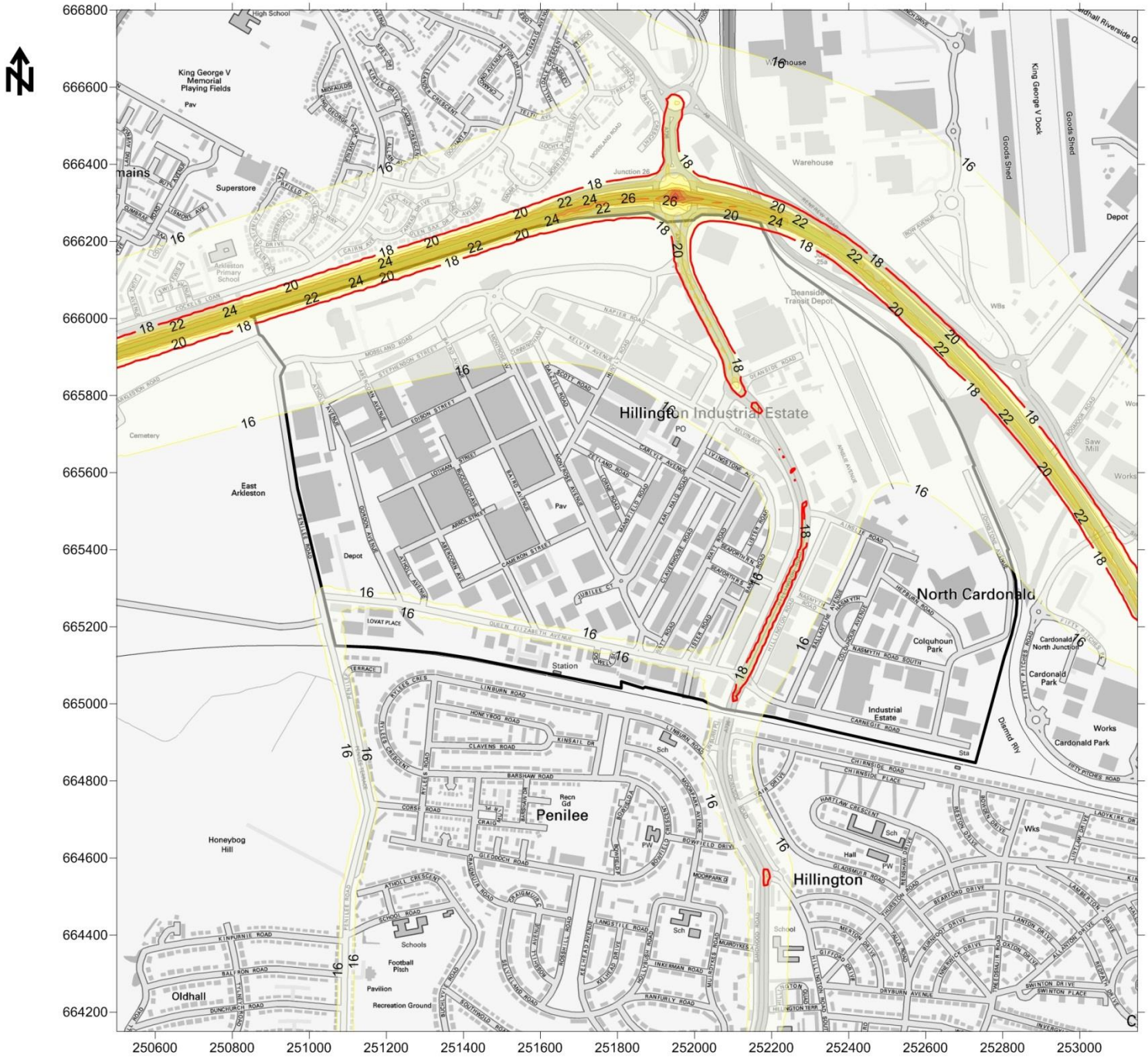

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Site Boundary

Predicted Annual Mean PM10 Concentration (µg/m3)

32
30
28
26
24
22
20
18
16

Title

Figure 8 - Predicted Annual Mean PM10 Concentration (µg/m3)
Do-Minimum

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

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Legend

Site Boundary

Predicted Annual Mean PM10 Concentration (µg/m3)

32
30
28
26
24
22
20
18
16

Title

Figure 9 - Predicted Annual Mean PM10 Concentration (µg/m3)
Do-Something

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

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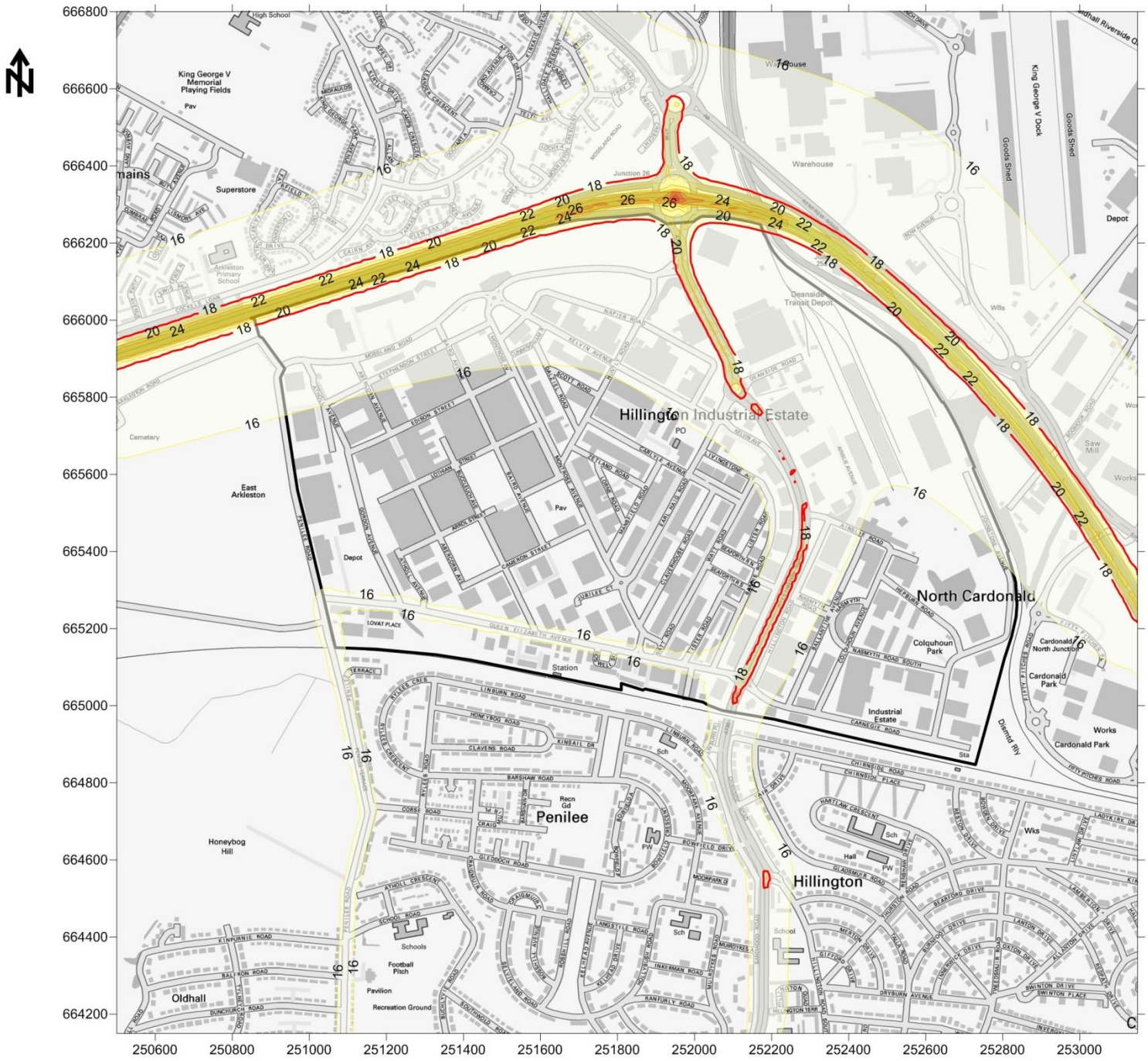

Legend

Site Boundary

Predicted Annual Mean PM10 Concentration (µg/m3)

32
30
28
26
24
22
20
18
16

Title

Figure 10 - Predicted Annual Mean PM10 Concentration (µg/m3)
Do-Something + Mitigation

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

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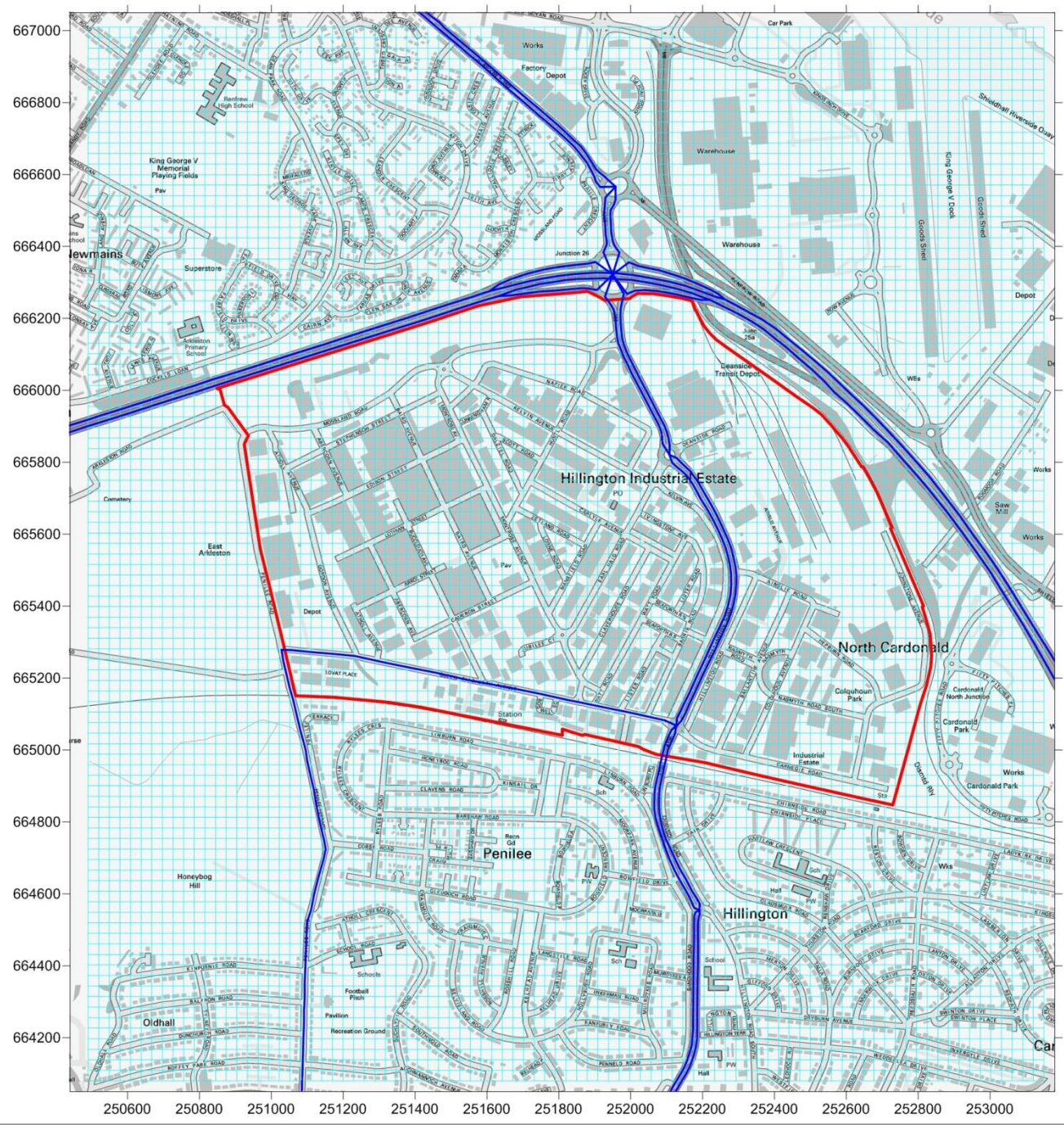

Legend

- Site Boundary
- Road Link
- Output Grid

Title

Figure 11 - ADMS Roads Input

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

Project Number

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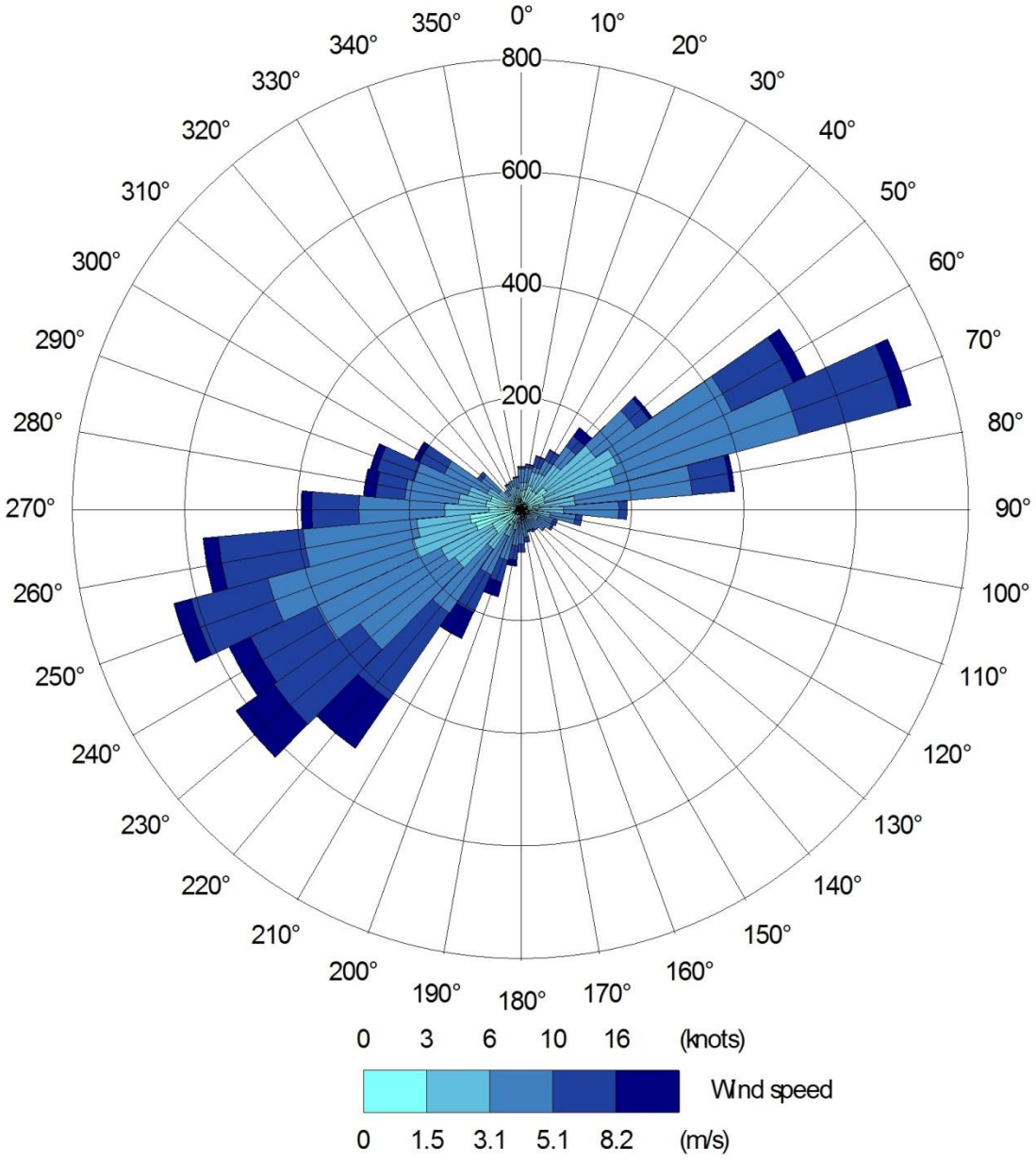

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Title

Figure 12 - Wind Rose of Glasgow Airport 2012 Meteorological Data

Project

Air Quality Assessment
Hillington Park Simplified Planning Zone, Glasgow

Project Number

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APPENDIX II ADMS-ROADS INPUT DATA

ASSESSMENT INPUTS

Vehicle trips associated with the development have the potential to result in air quality impacts as a result of increased traffic exhaust emissions. Dispersion modelling using ADMS-Roads was therefore undertaken to predict NO_2 and PM_{10} concentrations at sensitive locations both with and without the development in order to consider potential changes as a result of the proposals.

The dispersion model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and,
- Monin-Obukhov length.

Assessment inputs are described in the following subsections.

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 3.1.4). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

Assessment Area

Ambient concentrations were predicted over the assessment extent NGR: 250490, 664080 to 253150, 667010. A Cartesian grid with a resolution of 26.6m was used within the model to produce data suitable for contour plotting using the Surfer software package. Reference should be made to Figure 12 for a graphical representation of the assessment grid extents.

Traffic Flow Data

Traffic data for use in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition, was provided by Vectos, the Transport Consultants for the project.

Vehicle speeds were estimated based on the free-flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards. Table AII.1 shows the 2012 traffic data and road characteristics used in the verification scenario.

Reference should be made to Figure 11 for a graphical representation of the road link locations.

Table AII.1 Traffic Data Used in the Verification Assessment

Source		Road Width (m)	24-hour AADT Flows	HDV Portion of Fleet (%)	Mean Vehicle Speed (km/h)
1	M8 west eastbound	11.4	48,991	10.26	106
2	M8 east westbound	14.5	47,008	6.88	106
2a	M8 east eastbound	10.8	57,965	8.76	106
1a	M8 west westbound	11.3	59,360	10.87	106
3	M8 east - westbound sliproad	6.7	11,321	6.03	58
4	M8 eastbound off slip road	8.0	10,301	5.01	58
5	M8 westbound on slip road	5.6	12,080	5.49	58
6	M8 westbound off slip road	8.5	11,766	4.17	58
7	Hillington Road north northbound	15.0	18,668	5.26	42
7a	Hillington Road - northbound north of Deanside Road roundabout	6.9	18,668	5.26	42
7b	Hillington Road north of Deanside Road northbound	8.3	18,668	5.26	26
7c	Hillington Road north of Deanside Road southbound	7.2	15,671	4.76	26
7d	Hillington Road - northbound south of Deanside Road roundabout	6.9	15,671	4.76	42
7e	Hillington Road north southbound	13.6	15,671	4.76	26
8	Hillington Road south of Deanside Road roundabout northbound	11.6	9,515	4.72	26
8a	Hillington Road northbound south of Deanside Road roundabout	7.1	9,515	4.72	42
8b	Hillington Road north of Carnegie Road roundabout northbound	7.1	9,515	4.72	26
8c	Hillington Road north of Carnegie Road roundabout southbound	8.4	9,630	5.14	26
8d	Hillington Road - southbound south of Deanside Road roundabout	7.1	9,630	5.14	42
8e	Hillington Road south of Deanside Road roundabout southbound	12.5	9,630	5.14	26
9	Carnegie Road roundabout northbound south	8.8	8,514	2.85	26

Source		Road Width (m)	24-hour AADT Flows	HDV Portion of Fleet (%)	Mean Vehicle Speed (km/h)
9a	Hillington Road - northbound north of Carnegie Road roundabout	7.4	8,514	2.85	42
9b	Hillington Road South roundabout northbound	8.6	8,514	2.85	26
9c	Hillington Road South roundabout southbound	8.0	8,314	3.67	26
9d	Hillington Road - southbound north of Carnegie Road roundabout	7.8	8,314	3.67	42
9e	Carnegie Road roundabout southbound south	7.8	8,314	3.67	26
9f	Hillington Road South roundabout northbound	7.0	8,514	2.85	26
9g	Hillington Road south of Hillington Road South roundabout southbound	7.0	8,514	2.85	42
9h	Hillington Road South roundabout southbound	7.8	8,314	3.67	26
9i	Hillington Road south of Hillington Road South roundabout northbound	7.0	8,314	3.67	42
9j	Hillington Road south of Hillington Road South roundabout junction approach	11.6	16,828	3.25	42
9k	Hillington Road south of Hillington Road South roundabout junction approach south	14.2	16,828	3.25	26
13	Penilee Road	6.1	11,055	1.53	42
13a	Penilee Road junction approach	11.3	11,055	1.53	26
12	Queen Elizabeth Avenue junction approach	22.0	7,276	6.39	26
12a	Queen Elizabeth Avenue	5.8	7,276	6.39	42
12b	Queen Elizabeth Avenue roundabout approach	18.7	7,276	6.39	26
15	Hillington Road north of M8 roundabout northbound	7.2	14,102	4.47	42
15a	Hillington Road north of M8 roundabout northbound roundabout approach	14.2	14,102	4.47	58
15b	Hillington Road north of M8 roundabout - roundabout	16.2	14,102	4.47	42

Source		Road Width (m)	24-hour AADT Flows	HDV Portion of Fleet (%)	Mean Vehicle Speed (km/h)
15c	Hillington Road north of M8 roundabout southbound roundabout approach	15.6	12,684	5.43	42
15d	Hillington Road north of M8 roundabout southbound	10.1	12,684	5.43	58
15e	Hillington Road north of M8 roundabout southbound	10.4	12,684	5.43	42
16	Glasgow Road westbound roundabout exit	10.1	8,139	5.33	42
16a	Glasgow Road westbound	7.2	8,139	5.33	58
16b	Glasgow Road westbound	7.2	8,139	5.33	42
16c	Glasgow Road westbound	7.2	8,139	5.33	58
16d	Glasgow Road westbound	7.9	8,139	5.33	42
16e	Glasgow Road eastbound	6.8	9,257	4.85	42
16f	Glasgow Road eastbound	7.2	9,257	4.85	58
16g	Glasgow Road eastbound	7.2	9,257	4.85	42
16h	Glasgow Road eastbound	7.2	9,257	4.85	58
16i	Glasgow Road eastbound roundabout approach	11.9	9,257	4.85	42

Table AII.2 shows the 2024 traffic data used for the DM scenario and both DS scenarios. The road characteristics and fleet composition were the same as in the verification scenario.

Table AII.1 Traffic Data Used in the 2024 Assessments

Source		24-hour AADT Flows		
		DM	DS	DS + Mitigation
1	M8 west eastbound	53,937	54,710	54,370
2	M8 east westbound	51,198	52,058	51,338
2a	M8 east eastbound	60,538	61,460	60,778
1a	M8 west westbound	62,512	63,195	62,623
3	M8 east - westbound sliproad	14,474	15,156	14,584
4	M8 eastbound off slip road	12,874	13,796	13,114
5	M8 westbound on slip road	16,269	17,129	16,409

Source		24-hour AADT Flows		
		DM	DS	DS + Mitigation
6	M8 westbound off slip road	16,712	17,485	17,145
7	Hillington Road north northbound	24,379	26,010	24,644
7a	Hillington Road - northbound north of Deanside Road roundabout	24,379	26,010	24,644
7b	Hillington Road north of Deanside Road northbound	24,379	26,010	24,644
7c	Hillington Road north of Deanside Road southbound	20,145	21,913	20,606
7d	Hillington Road - northbound south of Deanside Road roundabout	20,145	21,913	20,606
7e	Hillington Road north southbound	20,145	21,913	20,606
8	Hillington Road south of Deanside Road roundabout northbound	12,485	12,712	12,466
8a	Hillington Road northbound south of Deanside Road roundabout	12,485	12,712	12,466
8b	Hillington Road north of Carnegie Road roundabout northbound	12,485	12,712	12,466
8c	Hillington Road north of Carnegie Road roundabout southbound	11,307	11,537	11,231
8d	Hillington Road - southbound south of Deanside Road roundabout	11,307	11,537	11,231
8e	Hillington Road south of Deanside Road roundabout southbound	11,307	11,537	11,231
9	Carnegie Road roundabout northbound south	12,113	12,536	12,200
9a	Hillington Road - northbound north of Carnegie Road roundabout	12,113	12,536	12,200
9b	Hillington Road South roundabout northbound	12,113	12,536	12,200
9c	Hillington Road South roundabout southbound	10,481	10,829	10,461
9d	Hillington Road - southbound north of Carnegie Road roundabout	10,481	10,829	10,461
9e	Carnegie Road roundabout southbound south	10,481	10,829	10,461
9f	Hillington Road South roundabout northbound	12,113	12,536	12,200
9g	Hillington Road south of Hillington Road South roundabout southbound	12,113	12,536	12,200

Source		24-hour AADT Flows		
		DM	DS	DS + Mitigation
9h	Hillington Road South roundabout southbound	10,481	10,829	10,461
9i	Hillington Road south of Hillington Road South roundabout northbound	10,481	10,829	10,461
9j	Hillington Road south of Hillington Road South roundabout junction approach	22,594	23,366	22,661
9k	Hillington Road south of Hillington Road South roundabout junction approach south	22,594	23,366	22,661
13	Penilee Road	11,803	12,241	11,017
13a	Penilee Road junction approach	11,803	12,241	11,017
12	Queen Elizabeth Avenue junction approach	8,154	8,635	7,878
12a	Queen Elizabeth Avenue	8,154	8,635	7,878
12b	Queen Elizabeth Avenue roundabout approach	8,154	8,635	7,878
15	Hillington Road north of M8 roundabout northbound	20,665	20,865	20,697
15a	Hillington Road north of M8 roundabout northbound roundabout approach	20,665	20,865	20,697
15b	Hillington Road north of M8 roundabout - roundabout	20,665	20,865	20,697
15c	Hillington Road north of M8 roundabout southbound roundabout approach	17,776	17,994	17,650
15d	Hillington Road north of M8 roundabout southbound	17,776	17,994	17,650
15e	Hillington Road north of M8 roundabout southbound	17,776	17,994	17,650
16	Glasgow Road westbound roundabout exit	9,650	9,819	9,551
16a	Glasgow Road westbound	9,650	9,819	9,551
16b	Glasgow Road westbound	9,650	9,819	9,551
16c	Glasgow Road westbound	9,650	9,819	9,551
16d	Glasgow Road westbound	9,650	9,819	9,551
16e	Glasgow Road eastbound	10,893	11,049	10,918
16f	Glasgow Road eastbound	10,893	11,049	10,918
16g	Glasgow Road eastbound	10,893	11,049	10,918

Source		24-hour AADT Flows		
		DM	DS	DS + Mitigation
16h	Glasgow Road eastbound	10,893	11,049	10,918
16i	Glasgow Road eastbound roundabout approach	10,893	11,049	10,918

Emission Factors

Emission rates for NO_x and PM_{10} for each road link were calculated from the information shown in Table All.1 and the Emission Factor Toolkit (version 5.2c). This incorporates updated COPERT4v8.1 vehicle emission factors for NO_x and PM_{10} and vehicle fleet information.

Air quality is predicted to improve in the future. However, there is current uncertainty over NO_2 concentrations in the UK as levels are not decreasing as previously expected following the introduction of new emission standards. In order to provide a robust assessment, emission factors for 2012 were utilised within the dispersion model. The use of 2024 traffic data and 2012 emission factors is considered to provide a worst-case scenario and therefore a sufficient level of confidence can be placed within the predicted pollution concentrations.

Meteorological Data

Meteorological data used in this assessment was taken from Glasgow Airport observation station over the period 1st January 2012 to 31st December 2012 (inclusive). Glasgow Airport weather station is located at NGR: 247778, 666809, which is approximately 4.3km north-west of the proposed development. DEFRA guidance LAQM.TG(09) recommends meteorological stations within 30km of an assessment area as being suitable for detailed modelling.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 12 for a wind rose of utilised meteorological data.

Roughness Length

A roughness length (z_0) of 1m was used in the residential development area dispersion model. This value of z_0 is considered appropriate for the morphology of the assessment area and is suggested within ADMS-Roads as being suitable for 'cities, woodlands'.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used in this dispersion modelling study. This value is considered appropriate for the nature of the assessment area and is suggested within ADMS-Roads as being suitable for 'cities and large towns'.

Background Concentrations

The background concentrations provided by DEFRA were used in the assessments to

represent existing annual mean NO_2 and PM_{10} levels throughout the modelling extents. As the spatial extent of the assessment area covers nine grid squares, the highest of the background concentrations were used in order to provide a worst-case estimation of pollution concentrations as a result of the proposed development. The grid square used was NGR: 252500, 666500 and the concentrations are shown in Table AII.3.

Table AII.3 Background Concentration 2012

Pollutant	2012 Background Concentration (µg/m^3)
NO_x	48.78
NO_2	28.81
PM_{10}	15.66

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the spreadsheet provided by DEFRA, which is the method detailed within LAQM.TG(09).

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and,
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

GCC and RC undertake diffusion tube monitoring of NO_2 concentrations at seven locations in the vicinity of the development and five sites were identified as suitable for use in the verification process. The GCC tube Mallaig Place and the RC tube Renfrew 24 were discounted for use in verification as they are both located at a significant distance from main roads and concentrations monitored at these locations would not be adequately replicated in the dispersion model.

Monitoring results were obtained from RC and the road contribution to total NO_x concentration calculated for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM.TG(09)[19]. The monitored annual mean NO_2 concentrations and calculated roadside NO_x concentrations are summarised in Table AII.4.

[19] Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

Table AII.4 Diffusion Tube Monitoring Results

Monitoring Location	2012 Monitored NO_2 Concentration ($\mu g/m^3$)	2012 Background NO_2 Concentration ($\mu g/m^3$)	Calculated Roadside NO_x Concentration ($\mu g/m^3$)
Renfrew 17	37.30	24.18	17.55
Renfrew 23	29.50	24.18	2.45
Renfrew 48	35.70	24.18	15.31
Renfrew 49	33.60	24.18	10.93
Renfrew 52	35.80	24.18	15.31

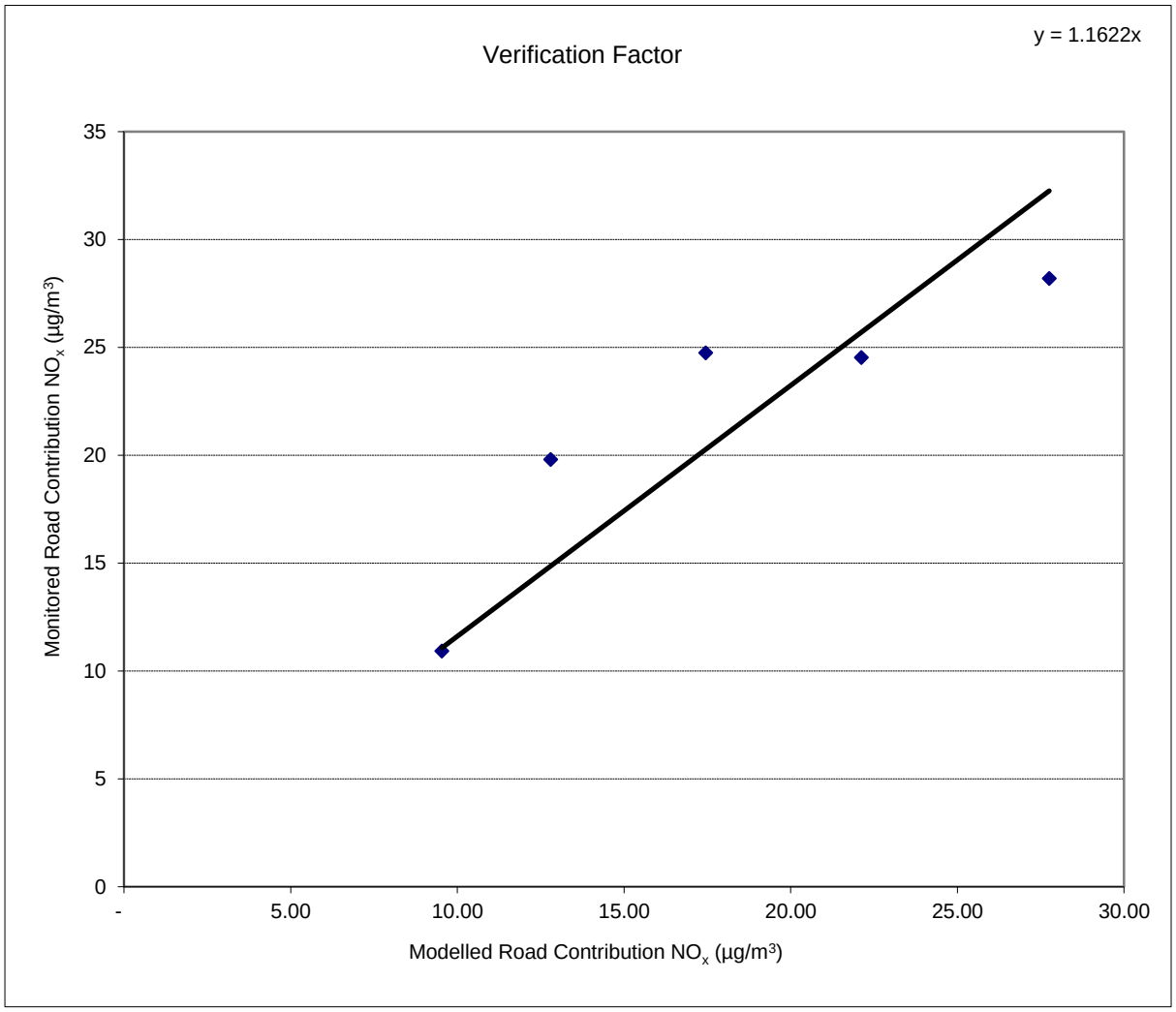
The dispersion model was run with traffic input data for 2012 to predict the NO_x concentration at the diffusion tube monitoring location. The result is shown in Table AII.5.

Table AII.5 Modelled Concentrations

Monitoring Location	Modelled Roadside NO_x Concentration ($\mu g/m^3$)
Renfrew 17	27.76
Renfrew 23	9.54
Renfrew 48	22.12
Renfrew 49	12.8
Renfrew 52	17.45

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trendline based on linear progression though zero calculated. This indicated that a verification factor of **1.1622** was required to be applied to all modelling results, as shown in Graph 1.

Graph 1 Verification Factor 1



Due to the absence of PM_{10} monitoring data in the vicinity of the proposed development, the NO_x verification factor of **1.1622** was used to adjust PM_{10} model predictions in accordance with the guidance provided within LAQM.TG(09).

APPENDIX III ASSESSOR'S CURRICULUM VITAE

ELEANOR MITCHELL

Air Quality Consultant

BSc, MSc

KEY EXPERIENCE:

Eleanor is a Environmental Consultant with specialist experience in the air quality sector. Her key capabilities include:

- Production of Air Quality Assessments to the Department for Environment, Food and Rural Affairs (DEFRA), Environment Agency and Environmental Protection UK (EPUK) methodologies for clients from the residential, retail, infrastructure and commercial sectors.
- Detailed dispersion modelling of road vehicle emissions using ADMS-Roads. Studies have included impact assessment of ground level pollutant concentrations and assessment of suitability of development sites for proposed end-use.
- Assessment of road vehicle exhaust emissions using the Design Manual for Roads and Bridges (DMRB) calculation spreadsheet.
- Assessment of dust impacts from construction sites to the Institute of Air Quality Management (IAQM) methodology.
- Execution of field odour surveys and assessments in accordance with the Environment Agency methodology.
- Production of air quality mitigation strategies for developments throughout the UK.
- Defining baseline air quality conditions and identification of sensitive areas.

QUALIFICATIONS:

- Bachelor of Science
- Master of Science
- Graduate IEMA

PROJECTS SUMMARY:

Residential and Mixed Use Developments

MCFC Beswick Project - Air Quality Assessment for large scale, mixed-use development of Manchester Institute of Sports Medicine and Research; Connell Sixth Form College; Beswick Wet and Dry Leisure Centre; a rugby pitch, local retail facilities, highways, public realm and utilities.

Great Peter Street, London - Air Quality Assessment in support of residential scheme in a street canyon, in central London within the Westminster AQMA.

Oxford Stadium, Oxford - Air Quality Assessment for large residential development within AQMA.

Traveller Site, Uttlesford - Air Quality Assessment for gypsy and traveller site in close proximity to the A1060 and the M11.

Residential Care Home, Winnersh - Air Quality Assessment for residential development located in the proximity of the M4.

Biggs Way, Congleton - Air Quality Assessment for residential scheme adjacent to an AQMA over a busy junction.

Finchley Road, Barnet - baseline Air Quality Assessment for a six floor, mixed use development in an AQMA.

Station Road, West Drayton - Air Quality Assessment for residential development located in an AQMA.

Grand Union Centre, London - mixed-use development in North Kensington within AQMA.

De Vere Village Urban Resort, Glasgow - Air Quality Assessment in support of a mixed use development comprising multi-purpose business space, commercial, leisure and residential uses, roads and parking and associated landscaping.

Scope Building and Tom Oakman Centre, Weale Road - extra care residential scheme within an AQMA.

Cambridge Road, Stansted Mountfitchet - construction phase assessment of fugitive dust emissions in accordance with IAQM methodology and dispersion modelling using ADMS-Roads in support of residential led development.

Commercial and Retail Developments

New Supermarket, Aylsham Road, Norwich - Air Quality Assessment including DMRB for retail scheme.

Shipley Retail Unit - Air Quality Assessment for large scale retail development with ancillary petrol filing station located in the vicinity of a number of AQMAs.

Maidstone Medical Campus - baseline Air Quality Assessment for a new medical campus adjacent to a number of ecological designations.

Educational Developments

South Leeds Sports Centre, Leeds - Air Quality Assessment in support of redevelopment of sports centre to provide new primary school adjacent to M621.

Little London Community Primary School, Leeds - baseline Air Quality Assessment to support new primary school.

Julian Headon House, London - Air Quality Assessment for redevelopment of building in Edgware to school with playground.

Infrastructure Developments

Whitefield Park and Ride, Bury - Air Quality Assessment assessing impacts of development with site access roads located within AQMA.

Jaguar Land Rover Multi-Storey Car Park, Solihull - Air Quality Assessment to assess movements within car park and on wider road network.

Radcliffe Park and Ride, Bury - an Air Quality Assessment assessing impacts of development with site access roads located within AQMA.

JETHRO REDMORE

Manager - Air Quality Impact Group

BEng (Hons), MSc, MIAQM, MIEnvSc, AIEMA, CEnv

KEY EXPERIENCE:

Jethro is a Chartered Environmentalist with specialist experience in the air quality sector. His key capabilities include:

- Production and management of Air Quality and Odour Assessments to DEFRA, Environment Agency and EPUK methodologies for a wide-range of clients from the retail, residential, infrastructure, commercial and industrial sectors.
- Significant proportion of assessments produced as part of over-arching Environmental Statements (ES) for large developments throughout the UK and internationally.
- Detailed dispersion modelling of road vehicle and industrial emissions using ADMS-Roads, ADMS-5, AERMOD-PRIME and BREEZE-ROADS. Studies have included impact assessment of ground level pollutant and odour concentrations and assessment of suitability of development sites for proposed end-use.
- Project management and co-ordination of EIAs and scoping reports for developments throughout the UK.
- Design and project management of pollutant monitoring campaigns to define baseline conditions and inform future assessment in accordance with DEFRA and Environment Agency guidance.
- Co-ordination and management of large-scale multi-disciplinary projects and submissions.
- Production and co-ordination of Environmental Permit applications for a variety of industrial sectors.
- Provision of expert advice to local government and international environmental bodies.

SELECT PROJECTS SUMMARY:

Residential Developments

Project Maltravers, Sheffield - Air Quality Assessment for a residential development consisting of 114 units and associated infrastructure.

North Street, Rugby - Air Quality Assessment in support of the conversion of office space into residential units in Rugby centre.

North Wharf Gardens, London - peer review of Environmental Impact Assessment undertaken for residential development.

Wheatstone House, London - Air Quality Assessment of mixed use scheme in AQMA.

Elephant and Castle Leisure Centre - baseline Air Quality Assessment for redevelopment.

Brook House, Tottenham - Air Quality Assessment for large residential development.

Poplar Business Park, Tower Hamlets - Air Quality Assessment for residential development.

Bicester Ecotown - dispersion modelling of energy centre for Environmental Impact Assessment.

Castleford Growth Delivery Plan - baseline air quality constraints assessment for town redevelopment.

Temple Point, Leeds - Air Quality Assessment for residential development adjacent to M1.

Commercial and Retail Developments

Pleasington Lakes, Blackburn - Environmental Impact Assessment for holiday village adjacent to M65.

Wakefield College - Air Quality Assessment for redevelopment of city centre campus in AQMA.

Deptford Terrace, Sunderland - Air Quality Assessment for mixed use development.

Stonebridge Lane, Liverpool - Air Quality Assessment for large superstore, local centre and retail uses.

Witton Park School, Blackburn - biomass boiler feasibility assessment.

Manchester Airport Cargo Shed - Air Quality Assessment of commercial development.

New Crown Wood School, Greenwich - Air Quality Assessment of biomass boiler.

Basford West, Crewe - Air Quality Assessment of industrial and business park.

Farnworth Superstore - Air Quality Assessment in support of new food superstore.

Wild Rose Holiday Park, Cumbria - Environmental Impact Assessment for holiday park extension.

Coolmore Estates, Seaham - Environmental Impact Assessment in support of creative centre of excellence.

Morton District Shopping Centre, Carlisle - air quality Environmental Impact Assessment for commercial development.

Manchester Airport Apron Extension - Environmental Impact Assessment including aircraft emission modelling.

Industrial Developments

Yorkshire Feedstuffs, Goole - Air Quality Assessment of new biomass installation.

Maesgwyn Biomass Plant - Air Quality Assessment including ecological assessment.

Cottesmore Lane Waste Transfer Station - Air Quality Assessment of waste facility in Lincolnshire.

Barnes Wallis Heat and Power, Cobham - biomass facility adjacent to AQMA.

Countrystyle Biomass Plant, Kent - Environmental Impact Assessment for biomass facility.

Brook Bridge Poultry Farm - Ammonia dispersion modelling of quail farm.