

T6. Supporting Information Relating to the Air Quality Chapter

- A. Glossary of Terms
- B. Air Quality Assessment Input Data
- C. Figures

A. Glossary of Terms

AADT - Annual Average Daily Traffic

AQLVs - Air Quality Limit Values

AQMA - Air Quality Management Area

AQOs - Air Quality Objectives

AQS - Air Quality Strategy

DEFRA - Department for Environment, Food and Rural Affairs

DM - Do-Minimum

DS - Do-Something

HDV - Heavy Duty Vehicle

HBC – Havant Borough Council

IAQM - Institute of Air Quality Management

LAs - Local Authorities

LAQM - Local Air Quality Management

LDV - Light Duty Vehicle

NO₂ - Nitrogen Dioxide

NPPF - National Planning Policy Framework

NPPG - National Planning Practice Guidance

PM₁₀ - Particulate matter with an aerodynamic diameter of less than 10µm

PCC – Portsmouth City Council

B. Air Quality Assessment Input Data

Introduction

The proposed development has the potential to cause air quality impacts as a result of exhaust emissions associated with vehicles travelling to and from the development, as well as expose future residents to any existing air quality issues at the site. In order to assess NO₂, and PM₁₀ concentrations at sensitive locations, detailed dispersion modelling was undertaken in accordance with the following methodology.

During a consultation with HBCC, local monitoring results were not available for 2019 revealed by the EHO in a telephonic conversation. Therefore, diffusion tube monitoring from Portsmouth City Council was used for the verification of the model for this assessment.

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Road's dispersion model (version 5.0.1.3). 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.

Modelling was undertaken for 2019 to allow verification against recent monitoring results and 2033 to represent the site opening year.

The model requires input data that details the following parameters:

- Traffic flow data;
- Assessment area,
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length (z_0); and,
- Monin-Obukhov length.

Additional options can also be selected within the ADMS-Roads interface to take account of site-specific characteristics that may model output, such as canyons, and gradients.

The relevant inputs are detailed in the following Sections.

Traffic Flow Data

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

Baseline traffic data for the Southampton Road, A3, A397 and Havant Road was not available from the TransportConsultants and was therefore supplemented with information from the Department for Transport (DfT)²³. The DfT web tool enables the user to view and download traffic flows on every link of the 'A' road and motorway network, as well as selected minor roads, in Great Britain for the years 1999 to 2021. It should be noted that the DfT web tool is referenced in DEFRA guidance²⁴ as being a suitable source of data for air quality assessments and it is therefore considered to provide a reasonable estimate of traffic flows in the vicinity of the site.

The baseline traffic data for the monitoring locations was converted to the site opening year utilising a factor obtained from TEMPro (Version 8.0). This software package has been developed by the DfT to calculate future traffic growth throughout the UK.

A summary of the traffic flow data is provided in Table T6.1. Road widths and vehicle speeds were estimated from aerial photography and UK highway design standards.

Table T6.1: Traffic Data							
Link		24-hour AADT flow			HDV Prop. of Fleet (%)	Mean Vehicle Speed (km/h)	Road Width (m)
		2019	2033 DM	2033 DS			
L1	Southampton Road West	23,820	25,946	26,446	1.5	35	12.6
L2	Southampton Road Bridge	23,820	25,946	26,446	1.5	25	13.9
L3	Southampton Road/ Allway Avenue	23,820	25,946	26,446	1.5	20	13.5
L4	Southampton Road	23,820	25,946	26,446	1.5	15	13.2
L5	Southampton Road/ Sixth Avenue	23,820	25,946	26,446	1.5	25	15.5
L6	Southampton Road/ Sundridge Close	23,820	25,946	26,446	1.5	20	13.5
L7	Spur Road Junction	23,820	25,946	26,446	1.5	25	14.2
L8	Roundabout1	19,855	21,626	22,126	2.3	25	15.2
L9	London Road	21,315	23,217	23,717	2.3	20	14.5
L10	London Road (A3)	21,315	23,217	23,717	2.3	35	15.2
L11	Northern Road	20,641	22,483	22,983	2.3	20	15.5
L12	Northern Road (A937)	20,641	22,483	22,983	2.3	25	15.2
L13	Spur Road	13,643	14,860	15,360	1.7	25	13.2
L14	Spur Road/ Lodge Avenue Road	13,643	14,860	15,360	1.7	35	13.5
L15	Hulbert Road North	7,365	8,543	8,880	2.3	35	10.3
L16	Hulbert Road Roundabout	7,365	8,543	8,880	2.3	25	11.2

Table T6.1: Traffic Data							
Link		24-hour AADT flow			HDV Prop. of Fleet (%)	Mean Vehicle Speed (km/h)	Road Width (m)
		2019	2033 DM	2033 DS			
L17	Roundbaout2	6,833	7,443	7,943	1.7	20	12.2
L18	Purbrook Way/ Farm Way	6,909	7,695	8,418	1.7	25	14.5
L19	Purbrook Way/ Linkenholt Way	6,909	7,695	8,418	2.3	35	14.2
L20	Hulbert Road South	8,193	9,457	9,794	2.3	25	15.2
L21	Hulbert Road (B2150)	8,193	9,457	9,794	1.7	40	14.5
L22	ASDA Link	1197	1,925	3,323	1.7	25	13.2
L23	Purbrook Way/ A3	17,840	19,767	20,489	2.3	25	15.2
L24	Purbrook Way East Slips	17,840	19,767	20,489	2.3	30	14.5
L25	Roundabout 3	13,483	14,687	15,187	1.7	25	13.5
L26	A3 Slip on	10,494	12,257	14,377	3.8	40	16.2
L27	Purbrook Way	12,117	14,115	16,957	3.8	30	13.5
L28	Roundabout 4	11,396	12,412	14,532	3.8	25	15.2
L29	A3 Slip off	11,706	13,596	15,716	3.8	35	16.2
L30	A3 South Merger	43,143	47,903	50,023	3.8	40	18.8
L31	A3 South	43,143	47,903	50,023	3.8	45	18.2
L32	A3 South Roundabout	43,143	47,903	50,023	3.8	50	18.5
L33	A3 (M North)	42,119	46,771	48,891	3.8	45	18.5
L34	A3 (M)	42,119	46,771	48,891	3.8	50	18.2
L35	Purbrook Way	10,364	12,178	15,021	1.7	35	15.5
L36	Purbrook Way/ College Road	10,364	12,178	15,021	1.7	35	15.2
L37	Purbrook Roundabout	10,364	12,178	15,021	3.8	25	15.7
L38	Roundabout 5	7,555	8,230	8,856	3.8	20	16.2
L39	Stakes Hill Road North	8,024	8,917	9,544	3.8	25	15.5
L40	Stakes Hill Road	8,024	8,917	9,544	3.8	40	14.7
L41	Purbrook Way West	10,637	12,312	13,275	3.8	25	15.5
L42	Ladybridge West	10,637	12,312	13,275	3.8	35	15.2
L43	Crook Horn Lane South	1,197	1,925	3,323	3.8	25	14.2
L44	Crook Horn Lane	1,556	2,143	3,155	3.8	35	13.5

Table T6.1: Traffic Data							
Link		24-hour AADT flow			HDV Prop. of Fleet (%)	Mean Vehicle Speed (km/h)	Road Width (m)
		2019	2033 DM	2033 DS			
L45	College Road	1,193	1,743	5,549	1.7	30	14.2
L46	College Road South	1,555	2,143	3,155	1.7	30	13.5
L47	Site Access	10	40	4,818	0.5	25	12.5
L48	Portsdown Hill Road East	7,085	7,929	8,363	0.5	30	14.5
L49	Porstdown Hill Road	7,072	7,928	8,506	3.8	35	14.2
L50	London Road South	21,315	23,217	23,717	3.8	35	10.3

Reference should be made to Figure 6.4 for a graphical representation of the road link locations.

Assessment Area

Ambient concentrations were predicted over NGR: 468530 to 106490 & 469520 to 107460. One Cartesian grid was used within the model to produce data suitable for contour plotting using the Surfer software package.

Reference should be made to Figure 6.4 for a graphical representation of the assessment grid extents.

Receptors potentially sensitive to changes in pollutant concentrations were included in the assessment as outlined in the main report text.

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emission Factor Toolkit (version 11). This has been produced by DEFRA and incorporates COPERT 5.3 vehicle emission factors and fleet information.

There is current uncertainty over NO₂ concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2019 emission factors were utilised in preference to the site's opening year in order to provide robust concentration predictions. As predictions for 2019 were verified, it is considered the results are an indication of worst-case concentrations during the operation of the proposals.

Meteorological Data

Meteorological data used in the assessment was taken from Southampton Airport meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive). Southampton Airport is located at NGR: 444992, 116764 which is approximately 27.8km north-west of the development.

It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature. All meteorological records used in the assessment were provided by APS Ltd, which is an established distributor of data within the UK.

Reference should be made to Figure 6.5 for a wind rose of utilised meteorological data.

Roughness Length

The z_0 is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used to describe the modelling extents and the meteorological site. This value is considered appropriate for the morphology of both areas and is suggested within ADMS-Roads as being suitable for 'parkland, open suburbia'.

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 to describe the modelling extents. This value is considered appropriate for the nature of the area and is suggested within ADMS-Roads as being suitable for 'cities and large towns'.

A minimum Monin-Obukhov length of 10m was used to describe the meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-Roads as being suitable for 'small towns <50,000'.

Background Concentrations

Annual mean NO_2 , and PM_{10} background concentrations for use in this assessment were taken from the DEFRA mapping study for the grid square containing the site, as shown in Table 12.

Similarly, to emission factors, background concentrations from 2019 were utilised in preference to the site opening year. This provided a robust assessment and is likely to overestimate pollutant concentrations during the operation of the proposals.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations were converted to NO_2 concentrations using the spreadsheet (version 8.1) provided by DEFRA, which is the method detailed within DEFRA guidance¹.

Verification

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

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emissions factors;

¹ DEFRA (2021): Local Air Quality Management Technical Guidance (TG16).

- 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.

For the purpose of this assessment model verification was undertaken for 2019 using traffic data, meteorological data, and monitoring results from this year. The choice of 2019 as the verification year aligns with the IAQM position statement 'Use of 2020 and 2021 Monitoring Datasets'²⁶, which states:

"If you are carrying out an air quality study that includes validation against monitoring data, use 2019 monitoring data as the last typical year"

HBC monitoring data was not representative of the site, however, PCC undertook monitoring of NO₂ concentrations at several locations near the site suitable for model verification during 2019. The results were obtained and the road contribution to total NO_x concentration calculated following the methodology contained within DEFRA guidance²⁷. The monitored annual mean NO₂ concentrations and calculated road NO_x concentrations are summarised in Table T6.2.

Table T6.2 Verification - Monitoring Result			
Monitoring Location		Monitored NO ₂ Concentration (µg/m ³)	Calculated Road NO ₂ Concentration (µg/m ³)
2	Rectory Road	22.3	8.57
72	60 Northern Road (NR-60)	23.8	29.42
73	52 Northern Road (NR-52)	30.3	28.65
135	Southampton Road - North (SR-N)	25.7	37.04
136	Southampton Road - South (SR-S)	26.7	32.35
147	Column 146 Southampton Road (SR-Col146)	26.2	31.94
148	Column 147 Southampton Road (SR-Col147)	24.2	35.33
149	Column 154 Southampton Road (SR-Col154)	33.9	31.36
150	Column 155 Southampton Road (SR-Col155)	37.5	32.92
151	Column 171 Southampton Road (SR-Col171)	31.8	30.48
152	Column 172 Southampton Road (SR-Col172)	42.0	32.22
153	Column 177 Southampton Road (SR-Col177)	36.3	29.31
154	Column 178 Southampton Road (SR-Col178)	43.0	31.22

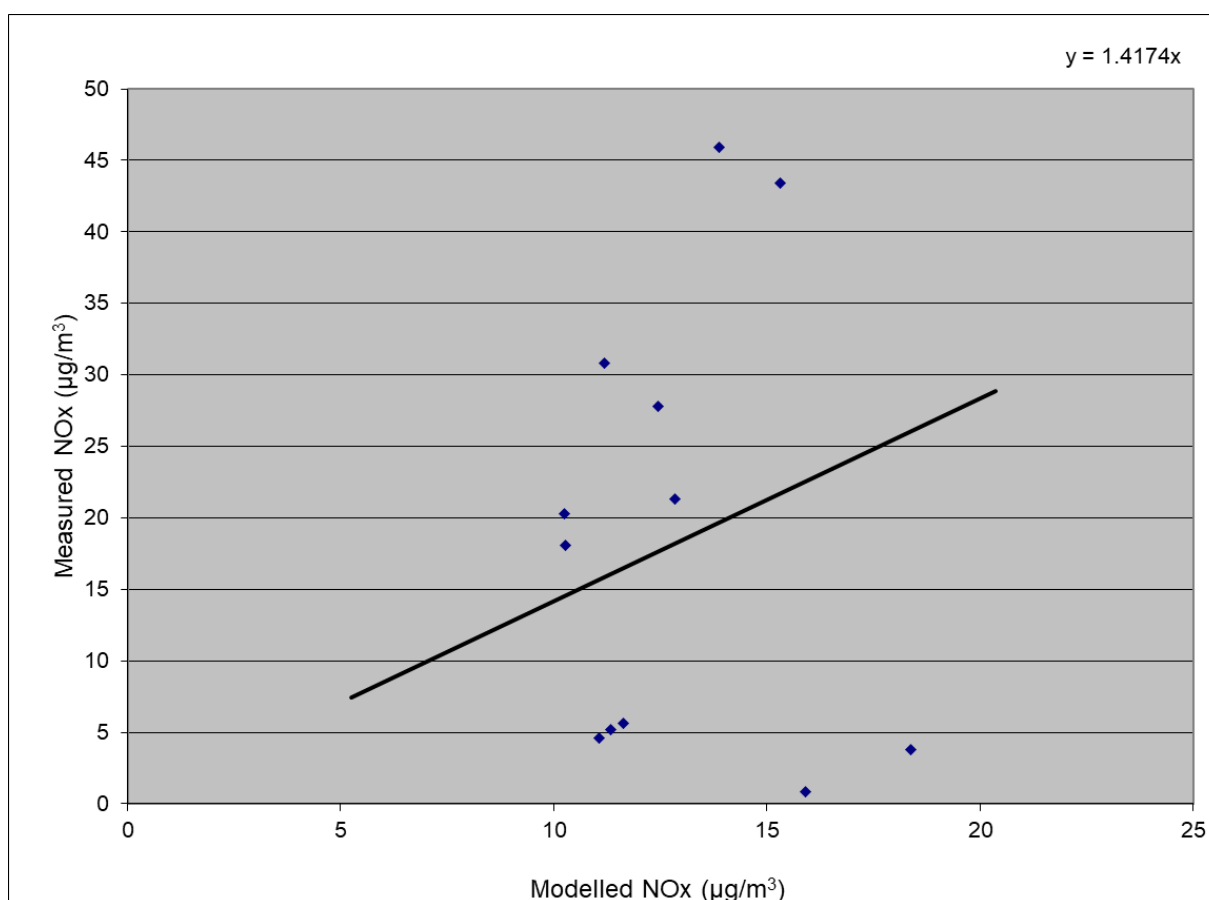
The annual mean road NO_x concentrations predicted from the dispersion model and the 2019 road NO_x concentrations calculated from the monitoring results are summarised in Table T6.3.

Table T6.3 Verification - Modelling Result

Monitoring Location		Calculated Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)
72	Rectory Road	15.96	11.34
73	60 Northern Road (NR-60)	14.46	10.27
135	52 Northern Road (NR-52)	25.86	18.37
136	Southampton Road - North (SR-N)	16.38	11.64
147	Southampton Road - South (SR-S)	15.57	11.06
148	Column 146 Southampton Road (SR-Col146)	22.37	15.89
149	Column 147 Southampton Road (SR-Col147)	14.43	10.25
150	Column 154 Southampton Road (SR-Col154)	17.52	12.45
151	Column 155 Southampton Road (SR-Col155)	18.07	12.84
152	Column 171 Southampton Road (SR-Col171)	21.56	15.32
153	Column 172 Southampton Road (SR-Col172)	15.75	11.19
154	Column 177 Southampton Road (SR-Col177)	19.55	13.89

The monitored and modelled road NO_x concentrations were graphed and the equation of the trendline based on linear progression through zero was calculated. This indicated that a verification factor of **1.4174** was required to be applied to all NO_x modelling results, as shown in Graph T6.1.

Graph T6.1 NO_x Verification Factor



Monitoring of PM₁₀ and PM_{2.5} concentrations is not undertaken at roadside locations within the assessment extent. The NO_x verification factor was therefore used to adjust model predictions of these species in lieu of more accurate data in accordance with DEFRA guidance.

C. Figures

Figure 6.1. Site Layout

Figure 6.2 Monitoring Locations

Figure 6.3. Buffer Zones for Construction Phase

Figure 6.4. Model Inputs/ Road Vehicle Exhaust Emissions Receptors

Figure 6.5. Wind Rose of 2019 Meteorological Data

Figure 6.6. NO₂ Predicted Levels in ug/m³.

Figure 6.7. PM₁₀ Predicted Levels in ug/m³.

Figure 6.8. PM_{s2.5} Predicted Levels in ug/m³.



Legend

 Site Boundary

Title

Site Boundary

Client

Dandara Southern Ltd.

Project

C010785

Project Name

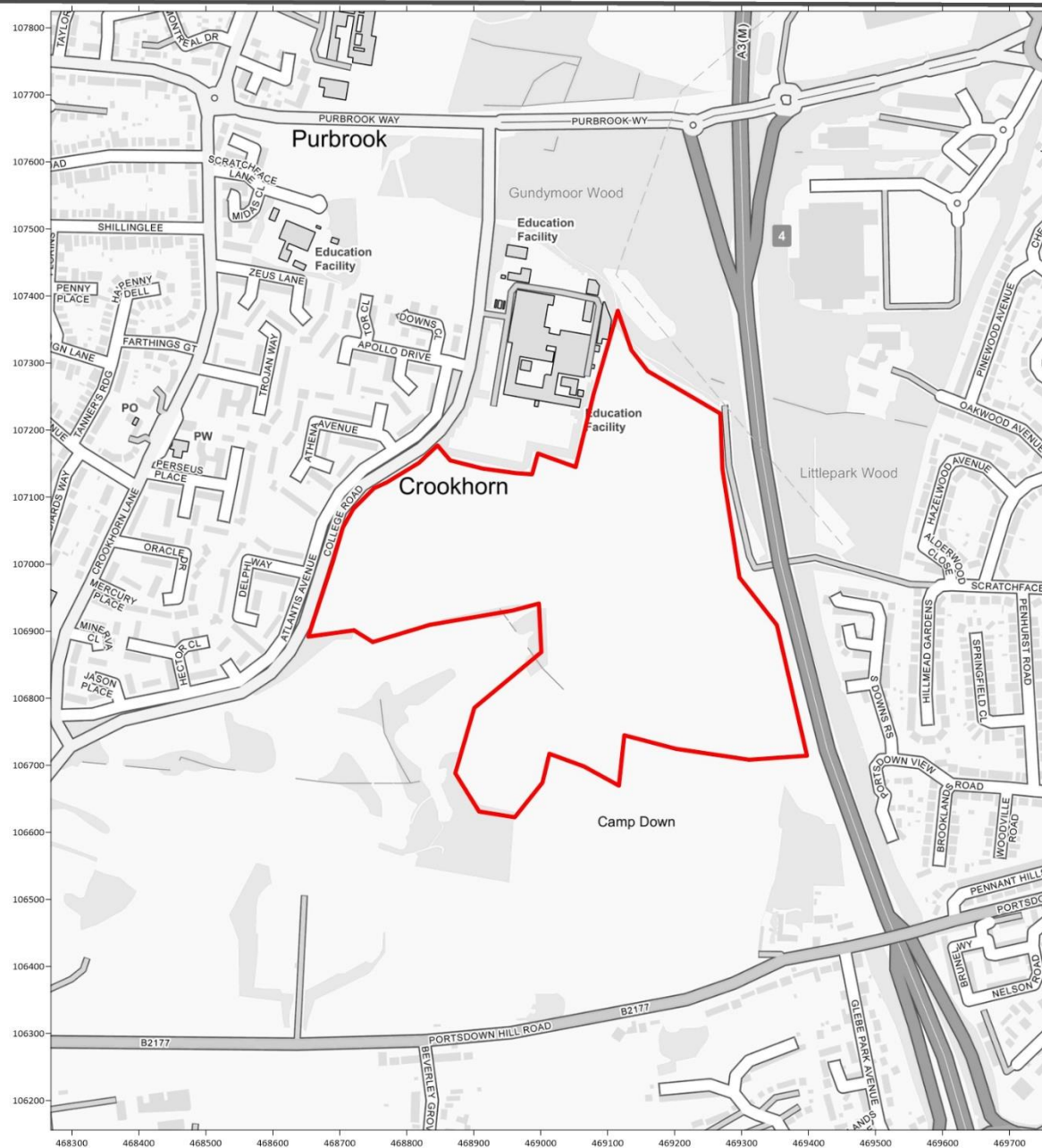
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Legend

-  Site Boundary
-  Diffusion Tube Monitoring Location

Title

Diffusion Tube Monitoring

Client

Dandara Southern Ltd.

Project

C010785

Project Name

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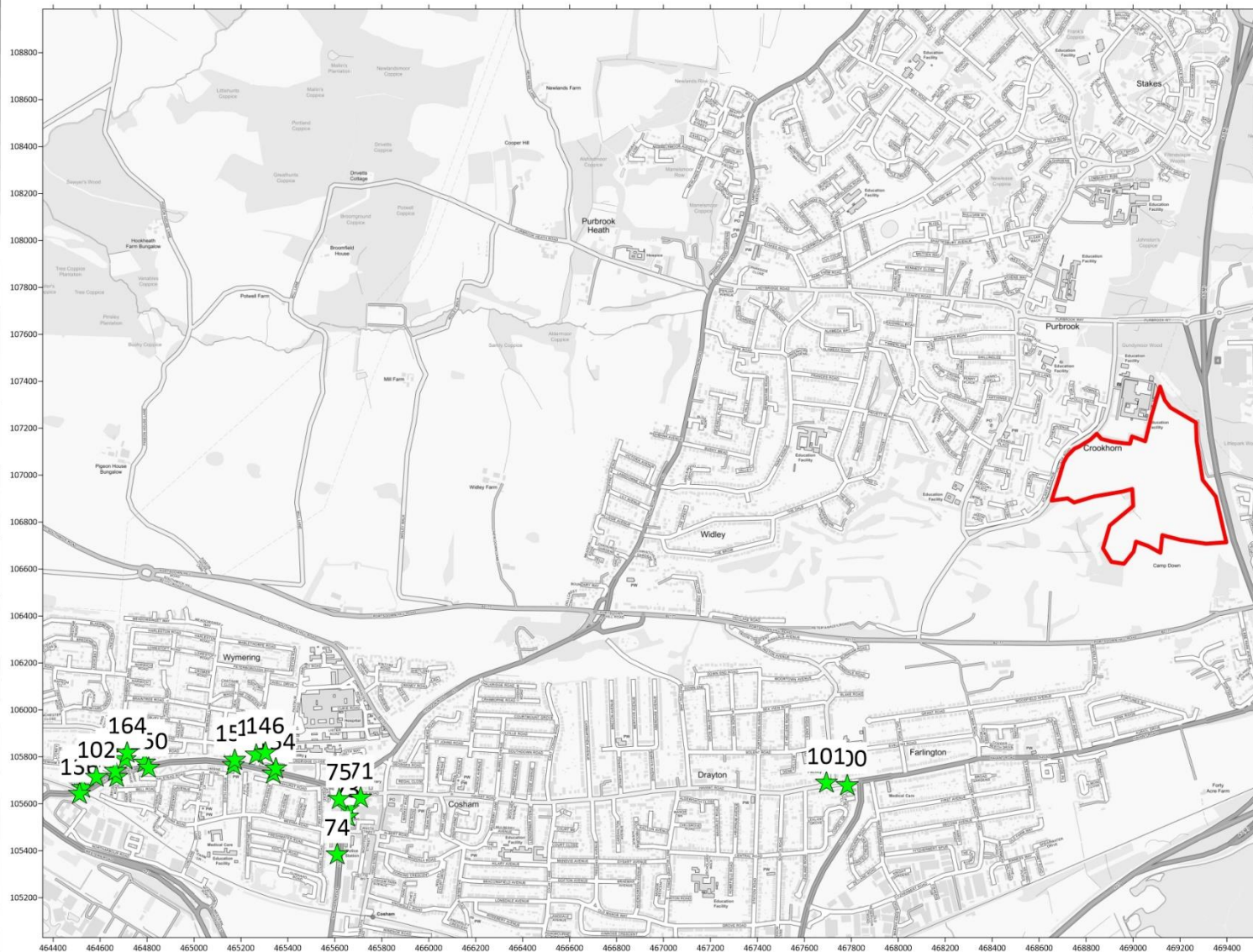
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Legend

-  Site Boundary
-  20 m Buffer Radius
-  50 m Buffer Radius
-  100 m Buffer Radius
-  350 m Buffer Radius

Title

Earthworks and Construction
Dust Buffer Zones

Client

Dandara Southern Ltd.

Project

C10785

Project Name

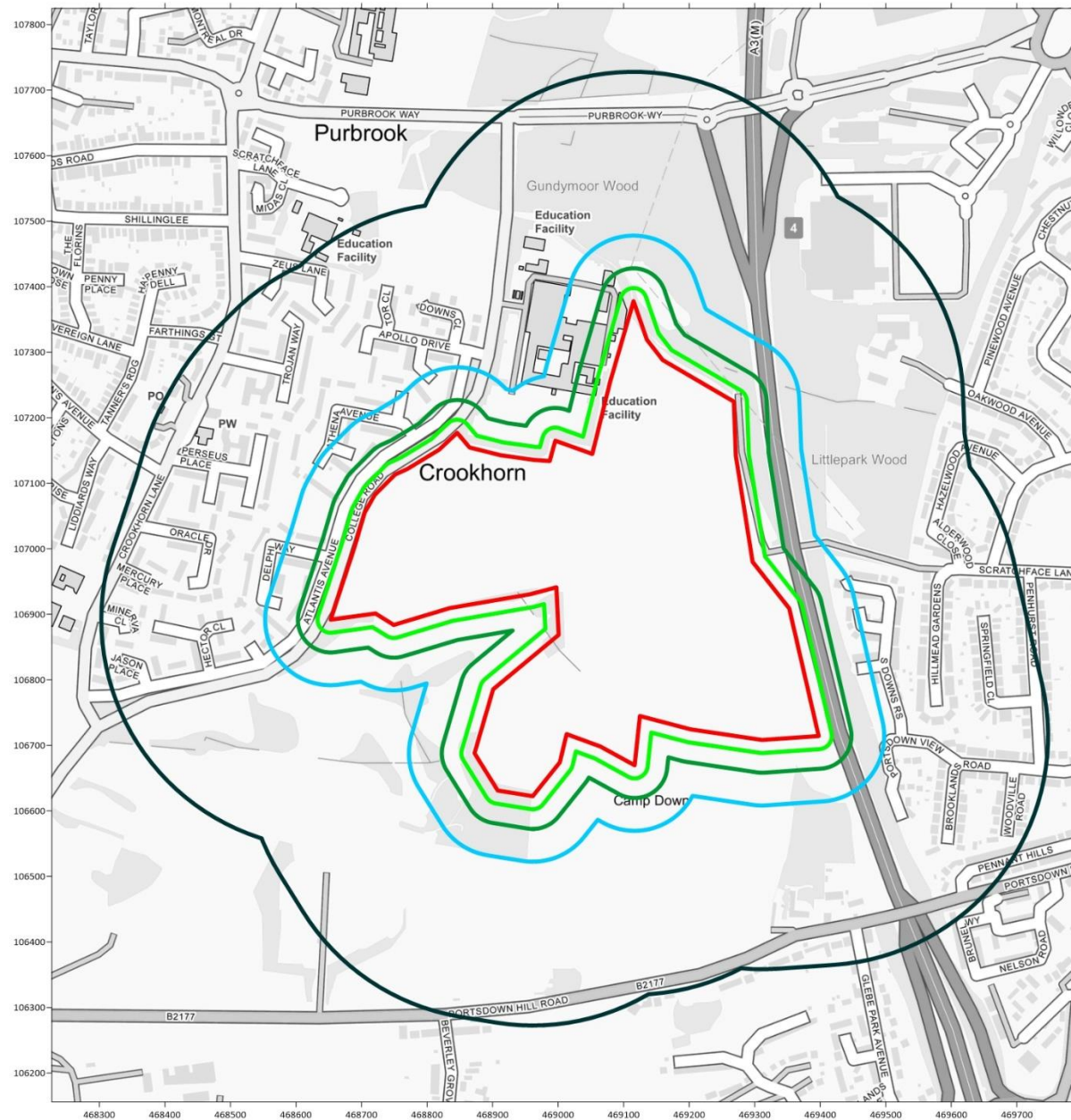
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Legend

-  Site Boundary
-  Modelled Road Link
-  Cartesian Grid
-  Diffusion Tube Monitoring Location
-  Sensitive Receptor Locations

Title

ADMS-Roads Input

Client

Dandara Southern Ltd.

Project

C010785

Project Name

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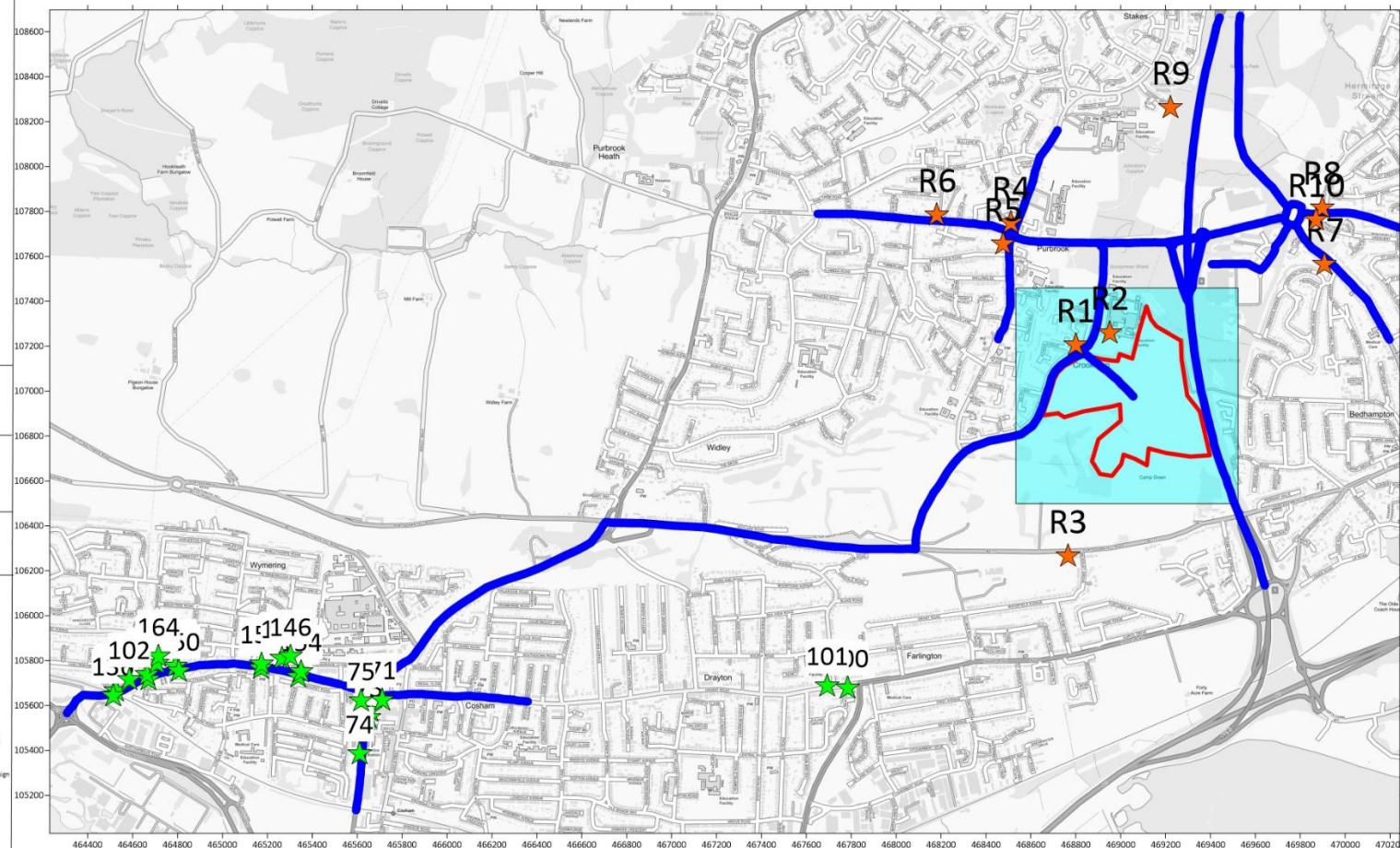
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Title
Wind Rose 2019 Southampton Airport
Meteorological Station

Client
Dandara Southern Ltd.

Project
CO10785

Project Name
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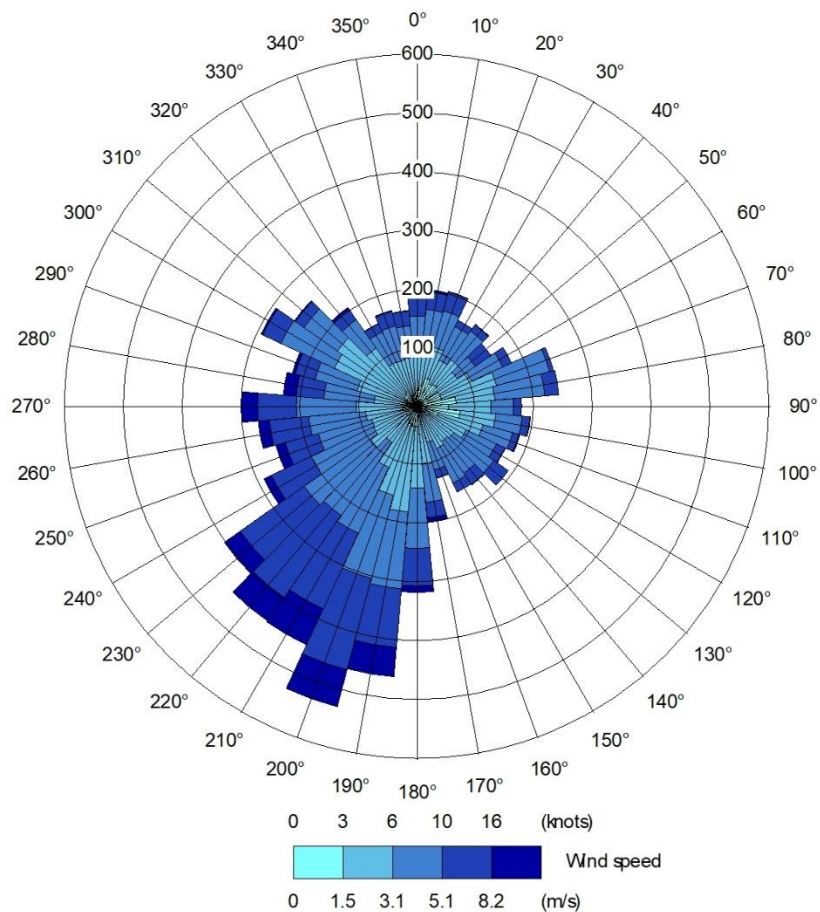
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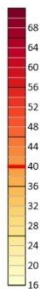




Legend

Site Boundary

Predicted Annual Mean
NO₂ Concentration (µg/m³)



Title

Predicted Annual Mean NO₂
Concentrations (µg/m³) 2033 DS

Client

Dandara Southern Ltd.

Project

C010785

Project Name

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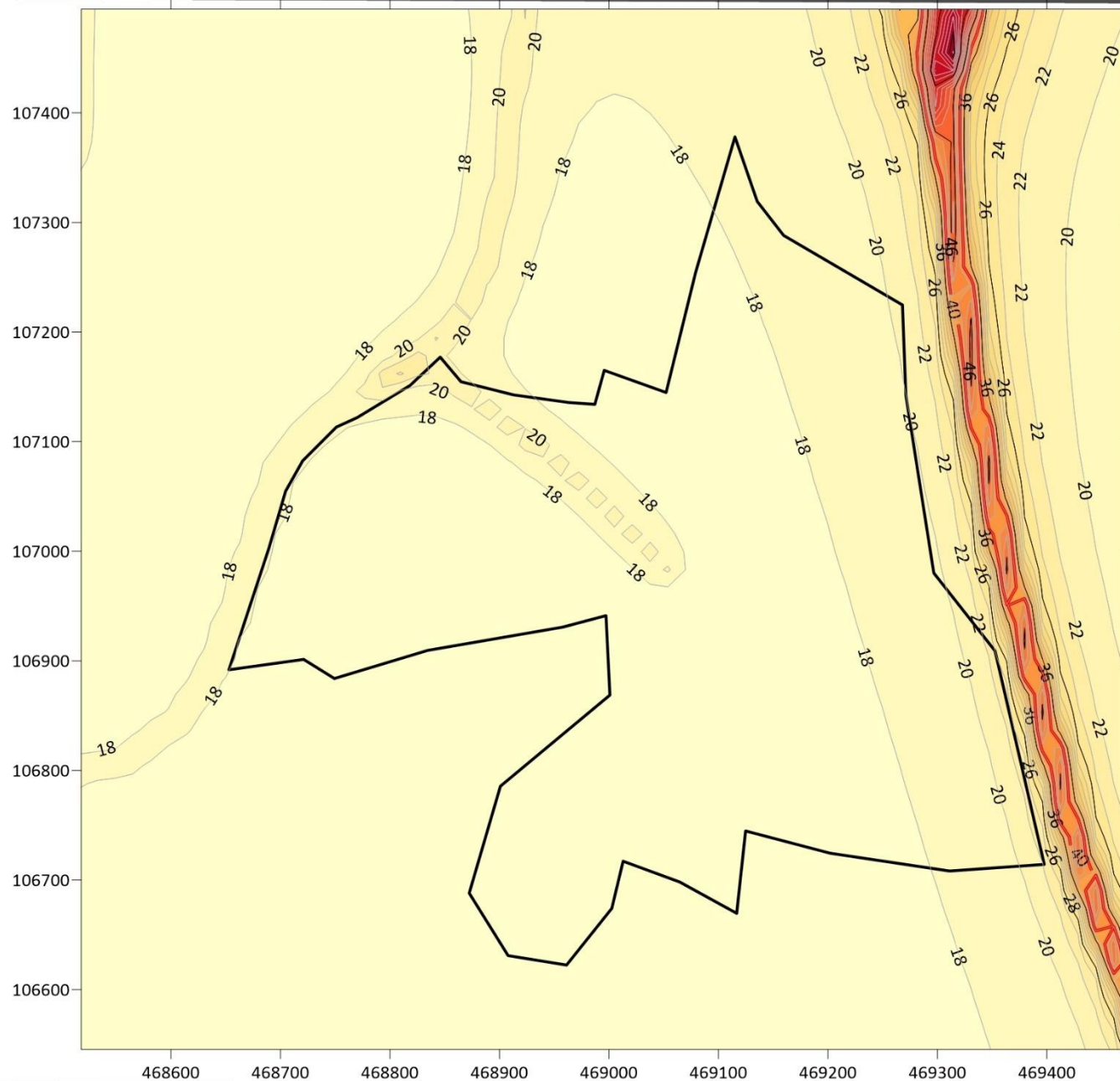
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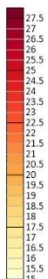




Legend

Site Boundary

Predicted Annual Mean
PM₁₀ Concentration (µg/m³)



Title
Predicted Annual Mean PM₁₀
Concentrations (µg/m³) 2033 DS

Client
Dandara Southern Ltd.

Project
C010785

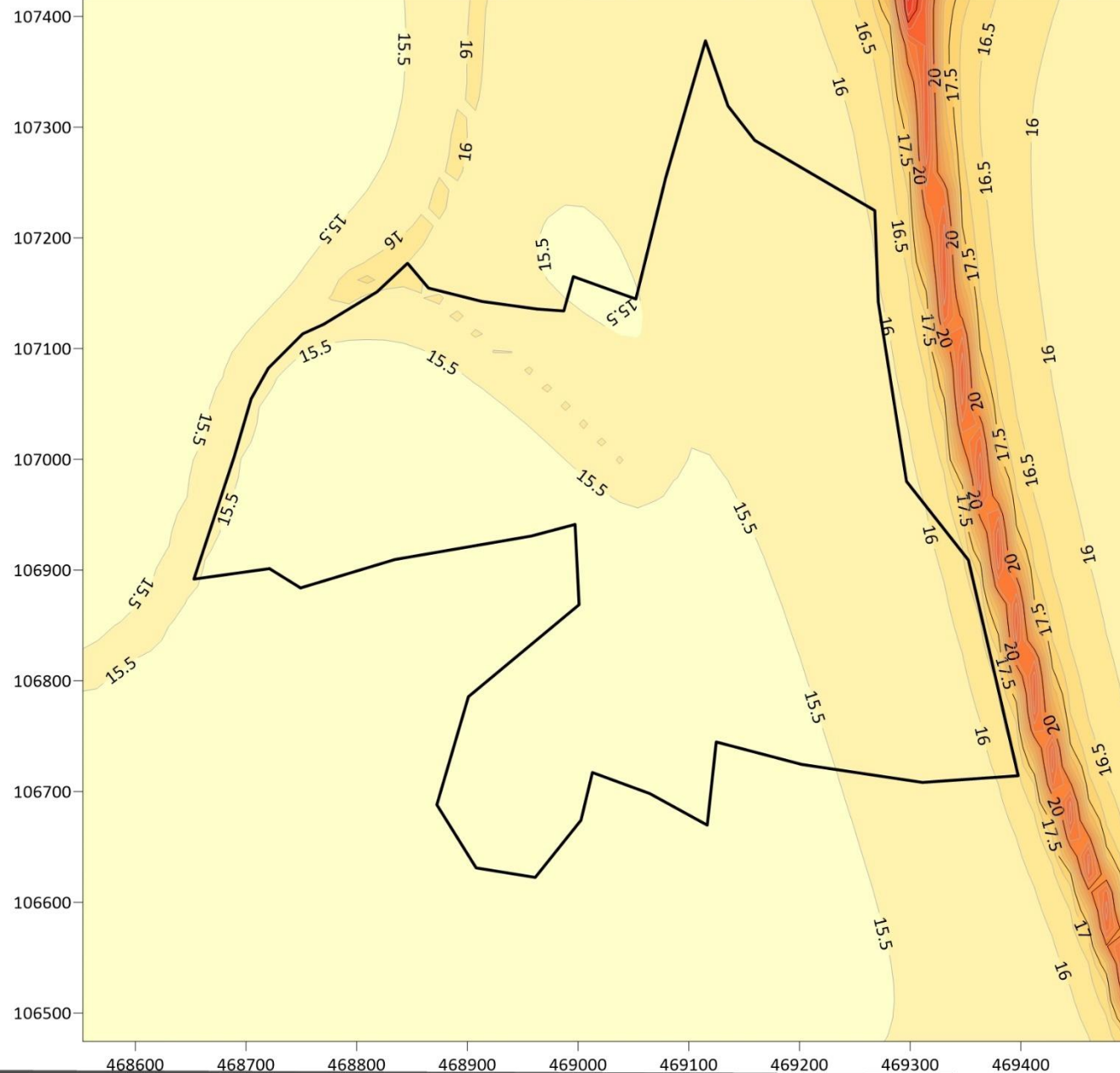
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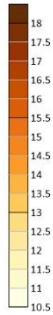




Legend

Site Boundary

Predicted Annual Mean
PM_{2.5} Concentration (µg/m³)



Title
Predicted Annual Mean PM_{2.5}
Concentrations (µg/m³) 2033 DS

Client
Dandara Southern Ltd.

Project
CO10785

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