

Air Quality Assessment
Langstone Flexible Generation Facility

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Executive Summary

Redmore Environmental Ltd was commissioned by Conrad Energy (Developments) Limited to undertake an Air Quality Assessment in support of a planning application for the erection of a flexible generation facility with associated ancillary infrastructure, access and boundary treatment, on land off Southmoor Lane, Langstone.

The installation will act as an electricity generating station that will supply electricity to the local distribution network to balance fluctuations in the National Grid network at a local level.

Combustion emissions from the facility have the potential to cause air quality impacts during normal operation. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and consider potential effects.

Dispersion modelling was undertaken in order to predict pollutant concentrations at sensitive locations as a result of emissions from the facility. The results indicated that impacts on pollutant concentrations were not predicted to be significant at any human receptor location in the vicinity of the site.

Impacts were also predicted at relevant ecological sites. The results indicated that emissions from the facility would not significantly affect existing conditions at any designation.

Based on the assessment results, air quality issues are not considered a constraint to planning consent for the proposals.

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1.0 INTRODUCTION

1.1 Background

- 1.1.1 Redmore Environmental Ltd was commissioned by Conrad Energy (Developments) Limited to undertake an Air Quality Assessment in support of a planning application for the erection of a flexible generation facility with associated ancillary infrastructure, access and boundary treatment, on land off Southmoor Lane, Langstone.
- 1.1.2 Combustion emissions from the facility have the potential to cause air quality impacts during normal operation. An Air Quality Assessment was therefore undertaken in order to determine baseline conditions and consider potential effects.

1.2 Site Location

- 1.2.1 The site falls to the east of Southmoor Lane within the existing Broadmarsh Business and Employment area and north of the Budds Farm Sewage Works. It lies within the built-up area and forms part of the Havant Lorry Park.
- 1.2.2 The site will be accessed from the existing access off Southmoor Lane, through the site. Internal access tracks will be used to enable both construction and maintenance vehicles to manoeuvre throughout the site.
- 1.2.3 The site falls entirely within Flood Zone 1 and Budds Farm Sewage Works to the south of the site benefits from flood defences. There are no heritage assets within close proximity of the site.
- 1.2.4 Reference should be made to Figure 1 for a map of the site and surrounding area.

1.3 Development Description and Context

- 1.3.1 The proposed development is the construction of a small scale electricity generating facility, including up to two 2.5MW gas reciprocating engines and ancillary plant. These will act as a backup electricity generation plant and operate during peak periods to supply power to the National Grid. It is anticipated that the plant will operate for a maximum of 3,000-hours per annum.

- 1.3.2 The operation of the plant will result in atmospheric emissions of combustion gases. These have the potential to cause air quality impacts at sensitive locations within the vicinity of the site. As such, potential effects have been assessed within the following report.

2.0 **LEGISLATION AND POLICY**

2.1 **Legislation**

2.1.1 The Air Quality Standards Regulations (2010) came into force on 11th June 2010 and include Air Quality Limit Values (AQLVs) for the following pollutants:

- Nitrogen dioxide (NO₂);
- Sulphur dioxide;
- Lead;
- Particulate matter with an aerodynamic diameter of less than 10µm;
- Particulate matter with an aerodynamic diameter of less than 2.5µm;
- Benzene; and,
- Carbon monoxide.

2.1.2 Target Values were also provided for an additional 5 pollutants. These include:

- Ozone;
- Arsenic;
- Cadmium;
- Nickel; and,
- Benzo(a)pyrene.

2.1.3 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 2007¹. 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. These are generally in line with the AQLVs, although the requirements for the determination of compliance vary.

2.1.4 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 ($\mu\text{g}/\text{m}^3$)	Averaging Period
NO ₂	40	Annual mean
	200	1-hour mean, not to be exceeded on more than 18 occasions per annum

2.1.5 Table 2 summarises the advice provided in DEFRA guidance² on where the AQOs for pollutants considered within this report apply.

Table 2 Examples of Where the Air Quality Objectives Apply

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

² Local Air Quality Management Technical Guidance (TG16), DEFRA, 2018.

2.2 Local Air Quality Management

2.2.1 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 comparing present and likely future pollutant concentrations against the AQOs. If it is predicted that levels at locations of relevant exposure, as summarised in Table 2, are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan, the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.3 Critical Loads and Levels

2.3.1 A critical load is defined by the UK Air Pollution Information System (APIS)³ as:

"A quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The exceedance of a critical load is defined as the atmospheric deposition of the pollutant above the critical load."

2.3.2 A critical level is defined as:

"Threshold for direct effects of pollutant concentrations according to current knowledge. Exceedance of a critical level is defined as the atmospheric concentration of the pollutant above the critical level."

2.3.3 A critical load refers to deposition of a pollutant, while a critical level refers to pollutant concentrations in the atmosphere (which usually have direct effects on vegetation or human health).

2.3.4 When pollutant loads (or concentrations) exceed the critical load or level it is considered that there is a risk of harmful effects. The excess over the critical load or level is termed the

³ UK Air Pollution Information System, www.apis.ac.uk.

exceedence. A larger exceedence is often considered to represent a greater risk of damage.

2.3.5 Maps of critical loads and levels and their exceedences have been used to show the potential extent of pollution damage and aid in developing strategies for reducing pollution. Decreasing deposition below the critical load is seen as means for preventing the risk of damage. However, even a decrease in the exceedence may infer that less damage will occur.

2.3.6 Table 3 presents the critical levels for the protection of vegetation for pollutants considered within this assessment.

Table 3 Critical Levels for the Protection of Vegetation

Pollutant	Critical Level	
	Concentration ($\mu\text{g}/\text{m}^3$)	Averaging Period
NO _x	30	Annual mean
	75	24-hour mean

2.3.7 Critical loads have been designated within the UK based on the sensitivity of the receiving habitat and have been identified for the relevant designations considered within the assessment in Section 3.5.

2.4 National Planning Policy

2.4.1 The revised National Planning Policy Framework⁴ (NPPF) was published in February 2019 and sets out the Government's planning policies for England and how these are expected to be applied.

2.4.2 The purpose of the planning system is to contribute to the achievements of sustainable development. In order to ensure this, the NPPF recognises three overarching objectives including the following of relevance to air quality:

⁴ NPPF, Ministry of Housing, Communities and Local Government, 2019.

"c) - An environmental objective - to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

2.4.3 Chapter 15 of the NPPF details objectives in relation to conserving and enhancing the natural environment. It states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

[...]

preventing new and existing development from contributing to, or being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality [...]"

2.4.4 The NPPF specifically recognises air quality as part of delivering sustainable development and states that:

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

2.4.5 The implications of the NPPF have been considered throughout this assessment.

2.5 National Planning Practice Guidance

2.5.1 The National Planning Practice Guidance⁵ (NPPG) web-based resource was launched by the Department for Communities and Local Government on 6th March 2014 and updated on 1st November 2019 to support the NPPF and make it more accessible. The air quality pages are summarised under the following headings:

1. What air quality considerations does planning need to address?
2. What is the role of plan-making with regard to air quality?
3. Are air quality concerns relevant to neighbourhood planning?
4. What information is available about air quality?
5. When could air quality considerations be relevant to the development management process?
6. What specific issues may need to be considered when assessing air quality impacts?
7. How detailed does an air quality assessment need to be?
8. How can an impact on air quality be mitigated?

2.5.2 These were reviewed and the relevant guidance considered as necessary throughout the undertaking of this assessment.

⁵ <https://www.gov.uk/guidance/air-quality--3>.

3.0 BASELINE

3.1 Introduction

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

3.2 Local Air Quality Management

- 3.2.1 As required by the Environment Act (1995), Havant Borough Council (HBC) has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that concentrations of all pollutants considered within the AQS are currently below the relevant AQOs. As such, no AQMAs have been designated within the borough.

3.3 Air Quality Monitoring

- 3.3.1 Monitoring of pollutant concentrations is undertaken by HBC throughout their area of jurisdiction. Recent results recorded in the vicinity of the site are shown in Table 5.

Table 4 Monitoring Results

Monitoring Site		Monitored NO ₂ Concentration (µg/m ³)		
		2016	2017	2018
7(B)	Brockhampton Lane	28.11	26.68	25.28

- 3.3.2 As shown in Table 4, annual mean NO₂ concentrations were below the AQO at the at the 7(B) monitoring site in recent years. Reference should be made to Figure 2 for a map of the survey position.

3.4 Background Pollutant Concentrations

- 3.4.1 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 Local Authorities in their Review and Assessment of air quality. The site is located in grid square NGR: 470500, 105500. Data

for this location was downloaded from the DEFRA website⁶ for the purpose of the assessment and is summarised in Table 5.

Table 5 Background Pollutant Concentration Predictions

Pollutant	Predicted 2020 Background Pollutant Concentration (µg/m ³)
NO ₂	20.79

3.4.2 As shown in Table 5, the predicted annual mean background NO₂ concentration is below the relevant AQO in the vicinity of the site.

3.5 Sensitive Receptors

3.5.1 A sensitive receptor is defined as any location which may be affected by changes in air quality. These have been defined for human and ecological receptors in the following Sections.

Human Receptors

3.5.2 A desk-top study was undertaken in order to identify any sensitive human receptor locations in the vicinity of the site that required specific consideration during the assessment. These are summarised in in Table 6.

Table 6 Sensitive Human Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Residential - The Mallards	471467.8	105322.6
R2	Residential - Brookmead Way	471482.5	105501.5
R3	Residential - Langbrook Close	471488.8	105619.3
R4	Residential - Longcroft Way	470902.5	106187.7
R5	The Wendy House Day Nursery, Brockhampton Road	471057.7	106291.2
R6	Residential - West Street	471349.5	106323.4

⁶ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>.

Receptor		NGR (m)	
		X	Y
R7	Residential - Brockhampton Road	470964.3	106117.8
R8	Residential - Mill Lane	471478.2	105011.0

3.5.3 Reference should be made to Figure 3 for a map of the sensitive human receptor locations.

Ecological Receptors

3.5.4 Atmospheric emissions from the facility also have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The Conservation of Habitats and Species Regulations (2010) and subsequent amendments require competent authorities to review applications and consents that have the potential to impact on ecological designations. A study was therefore undertaken to identify the following sites of ecological or nature conservation importance:

- Special Areas of Conservation (SAC), Special Protection Areas (SPAs) or Ramsar sites within 5km of the facility; and,
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs), Local Wildlife Sites (LWSs) and ancient woodland within 2km of the facility.

3.5.5 The study was completed using the Multi-Agency Geographic Information for the Countryside (MAGIC) web-based interactive mapping service⁷ which draws together information on key environmental schemes and designations and a habitat screening report from the Environment Agency (EA). The study indicated the following designations within the relevant distances:

- Solent & Isle of Wight Lagoons SAC;
- Solent Maritime SAC;
- Chichester and Langstone Harbours SPA and Ramsar;
- Chichester Harbour SSSI;

⁷ Multi-Agency Geographic Information for the Countryside, www.magic.gov.uk.

- Langstone Harbour SSSI;
- Hayling Billy LNR;
- West Hayling LNR;
- Farlington Marshes LNR;
- Littlepark Wood (East) LWS;
- Pyecroft's Meadow LWS;
- Southmoor - Big Field (south edge) LWS;
- Langstone Mill Pond LWS;
- Southmoor Reserve LWS;
- Wade Court Park LWS;
- Farlington Marshes Grassland LWS;
- Fields off Havant Road LWS;
- St Faith's Churchyard LWS;
- Camp Down Grassland Remnants LWS;
- Hayling Billy Line LWS;
- Ancient woodland; and,
- Mudflats protected habitat.

3.5.6 For the purpose of the modelling assessment discrete receptors were placed at the closest point of each designation to the facility to ensure the maximum potential impact was predicted. These are summarised in Table 7.

Table 7 Ecological Receptor Locations

Receptor		NGR (m)	
		X	Y
E1	Ancient Woodland	469535.2	106981.4
E2	Farlington Marshes LNR, Chichester and Langstone Harbour Ramsar	469015.1	105353.4
E3	West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSI	471821.7	104259.3
E4	Hayling Billy LNR, Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	471918.5	103901.4
E5	Mudflats - Protected Habitat	470688.6	105683.2

Receptor		NGR (m)	
		X	Y
E6	Southmoor Reserve LWS	471216.0	105249.2
E7	Southmoor - Big Field (south edge) LWS	470896.1	104975.6
E8	Hayling Billy Line LWS, West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSSI	471823.5	104118.8
E9	Langstone Mill Pond LWS	471976.9	105096.0
E10	Wade Court Park LWS	471909.2	105430.6
E11	St Faiths Church Yard LWS	471725.9	106207.8
E12	Farlington Marshes Grassland LWS	469492.0	105648.0
E13	Fields off Havant Road LWS	469419.0	106004.7
E14	Camp Down Grassland Remnants LWS	469315.4	106501.2
E15	Pyecroft's Meadow LWS	469068.7	106504.7
E16	Littlewood Park (east) LWS	469410.5	107028.3
E17	Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	472130.0	105152.9
E18	Chichester and Langstone Harbour Ramsar and SPA, Langstone Harbour SSSI, Solent & Isle of Wight Lagoons SAC	470446.4	105364.6

3.5.7 Reference should be made to Figure 3 for a map of the ecological receptors.

3.5.8 Critical loads have been designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of the APIS⁸ and MAGIC⁹ websites, as well as the relevant site designations and publicly available information, were undertaken in order to identify the most suitable habitat description and associated critical load for the area of each designation considered within the assessment.

3.5.9 The relevant nitrogen deposition critical loads are presented in Table 8.

⁸ <http://www.apis.ac.uk/>.

⁹ Multi-Agency Geographic Information for the Countryside, www.magic.gov.uk.

Table 8 Critical Loads for Nitrogen Deposition

Receptor	Feature	APIS Habitat	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
E1	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	20
E2	Coastal and Floodplain Grazing Marsh	Low and medium altitude hay meadows	20	30
E3	Perennial vegetation of stony banks (H1220)	Coastal stable dune grasslands	8	15
E4	Perennial vegetation of stony banks (H1220)	Coastal stable dune grasslands	8	15
E5	Coastal saltmarsh	Pioneer, low-mid, mid-upper saltmarshes	20	30
E6	Coastal saltmarsh	Pioneer, low-mid, mid-upper saltmarshes	20	30
E7	Coastal saltmarsh	Pioneer, low-mid, mid-upper saltmarshes	20	30
E8	Perennial vegetation of stony banks (H1220)	Coastal stable dune grasslands	8	15
E9	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	20
E10	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	20
E11	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	20
E12	Neutral Grassland	Low and medium altitude hay meadows	20	30
E13	Neutral Grassland	Low and medium altitude hay meadows	20	30
E14	Neutral Grassland	Low and medium altitude hay meadows	20	30
E15	Neutral Grassland	Low and medium altitude hay meadows	20	30
E16	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	20
E17	Perennial vegetation of stony banks (H1220)	Coastal stable dune grasslands	8	15

Receptor	Feature	APIS Habitat	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
E18	Coastal lagoons (H1150)	Pioneer, low-mid, mid-upper saltmarshes	20	30

3.5.10 The site features were also reviewed to identify the habitat types most sensitive to acid deposition. These are summarised in Table 9.

Table 9 Critical Loads for Acid Deposition

Receptor	Feature	APIS Habitat	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
E1	Broadleaved, Mixed and Yew Woodland	Broadleaved/Coniferous unmanaged woodland	0.357	1.838	21.95
E2	Coastal and Floodplain Grazing Marsh	N/A	-	-	-
E3	Perennial vegetation of stony banks (H1220)	Acid grassland	0.223	0.26	0.626
E4	Perennial vegetation of stony banks (H1220)	Acid grassland	0.223	0.26	0.626
E5	Coastal saltmarsh	N/A	-	-	-
E6	Coastal saltmarsh	N/A	-	-	-
E7	Coastal saltmarsh	N/A	-	-	-
E8	Perennial vegetation of stony banks (H1220)	Acid grassland	0.223	0.26	0.626
E9	Broadleaved, Mixed and Yew Woodland	Broadleaved/Coniferous unmanaged woodland	0.357	1.838	21.95
E10	Broadleaved, Mixed and Yew Woodland	Broadleaved/Coniferous unmanaged woodland	0.357	1.838	21.95
E11	Broadleaved, Mixed and Yew Woodland	Broadleaved/Coniferous unmanaged woodland	0.357	1.838	21.95

Receptor	Feature	APIS Habitat	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
E12	Neutral Grassland	Calcareous grassland (using base cation)	1.071	4	5.071
E13	Neutral Grassland	Calcareous grassland (using base cation)	1.071	4	5.071
E14	Neutral Grassland	Calcareous grassland (using base cation)	1.071	4	5.071
E15	Neutral Grassland	Calcareous grassland (using base cation)	1.071	4	5.071
E16	Broadleaved, Mixed and Yew Woodland	Broadleaved/Coniferous unmanaged woodland	0.357	1.838	21.95
E17	Perennial vegetation of stony banks (H1220)	Acid grassland	0.223	0.26	0.626
E18	Coastal lagoons (H1150)	Not sensitive	-	-	-

3.5.11 Baseline NO_x concentrations at each ecological receptor were obtained from the DEFRA website¹⁰ and deposition rates were obtained from the APIS website. These are summarised in Table 10.

Table 10 Baseline Pollution Levels at Ecological Receptors

Receptor		Annual Mean NO _x Conc. (µg/m ³)	Baseline Deposition Rate		
			Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)	
				Nitrogen	Sulphur
E1	Ancient Woodland	28.11	23.38	1.67	0.24
E2	Farlington Marshes LNR, Chichester and Langstone Harbour Ramsar	34.79	14.14	1.01	0.20
E3	West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSI	18.83	11.30	0.80	0.20

¹⁰ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>.

Receptor		Annual Mean NO _x Conc. (µg/m ³)	Baseline Deposition Rate		
			Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)	
				Nitrogen	Sulphur
E4	Hayling Billy LNR, Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	17.57	11.30	0.80	0.20
E5	Mudflats - Protected Habitat	31.39	13.58	0.97	0.19
E6	Southmoor Reserve LWS	28.89	13.58	0.97	0.19
E7	Southmoor - Big Field (south edge) LWS	19.46	11.34	0.81	0.15
E8	Hayling Billy Line LWS, West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSI	18.83	11.30	0.80	0.20
E9	Langstone Mill Pond LWS	28.89	22.82	1.63	0.23
E10	Wade Court Park LWS	28.89	22.82	1.63	0.23
E11	St Faiths Church Yard LWS	26.73	22.82	1.63	0.23
E12	Farlington Marshes Grassland LWS	34.79	14.14	1.01	0.20
E13	Fields off Havant Road LWS	28.11	14.14	1.01	0.20
E14	Camp Down Grassland Remnants LWS	28.11	14.14	1.01	0.20
E15	Pyecroft's Meadow LWS	28.11	14.14	1.01	0.20
E16	Littlewood Park (east) LWS	25.07	23.38	1.67	0.24
E17	Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	22.42	13.60	1.00	0.20
E18	Chichester and Langstone Harbour Ramsar and SPA, Langstone Harbour SSSI, Solent & Isle of Wight Lagoons SAC	31.39	13.60	1.00	0.20

4.0 **METHODOLOGY**

4.1 **Introduction**

- 4.1.1 Combustion emissions from the plant have the potential to cause air quality impacts in the vicinity of the site. These have been quantified through dispersion modelling in accordance with the methodology outlined in the following Sections.

4.2 **Dispersion Model**

- 4.2.1 Dispersion modelling was undertaken using ADMS-5.2 (v5.2.4.0), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS-5 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions.
- 4.2.2 The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected long-term and short-term averages.

4.3 **Modelling Scenarios**

- 4.3.1 The scenarios considered in the modelling assessment for human receptors are summarised in Table 11.

Table 11 Human Receptor Assessment Scenarios

Parameter	Modelled As	
	Short Term	Long Term
NO ₂	99.63 rd percentile (%ile) 1-hour mean	Annual mean

4.3.2 The EA have issued guidance¹¹ on dispersion modelling of emissions from back-up generating plant. This includes a method for statistical analysis using the hypergeometric probability distribution in order to identify the potential for an exceedance of the 1-hour AQO for NO₂ for facilities that operate periodically on an undefined schedule.

4.3.3 The facility will operate for a maximum of 3,000-hours per annum. Using the hypergeometric probability distribution method, it was determined that should the results indicate 32 or more instances of NO₂ concentrations over 200µg/m³ within a year, then the probability of producing 19 instances of NO₂ concentrations over 200µg/m³, and therefore an exceedance of the AQO, within 3,000 operational hours would be 0.3%. As the plant can operate for periods in excess of 1-hour, this value was multiplied by 2.5 in accordance with the guidance¹². This provided a probability of 0.8%. The EA indicate that:

"Probabilities of 1% or less indicate exceedances are highly unlikely."

4.3.4 This level of probability is considered to be acceptable by the EA and therefore an appropriate criterion for use in the assessment.

4.3.5 Based on the number of instances determined previously, the 99.63rd %ile was calculated for use in the modelling assessment. As such, should predicted 99.63rd %ile 1-hour mean NO₂ concentrations be under 200µg/m³ then there is less than 1% probability of an AQO exceedance and the plant is considered acceptable in accordance with the utilised guidance¹³.

4.3.6 The EA guidance¹⁴ indicates that annual mean PCs can be calculated by scaling down long term predictions by the total number of operational hours over the total number of hours in the operating envelope. This approach was therefore adopted throughout the assessment.

¹¹ Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators, EA, 2018.

¹² Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators, EA, 2018.

¹³ Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators, EA, 2018.

¹⁴ Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators, EA, 2018.

4.3.7 The scenarios considered for ecological receptors in the modelling assessment are summarised in Table 12.

Table 12 Ecological Receptor Assessment Scenarios

Parameter	Modelled As	
	Short Term	Long Term
NO _x	24-hour mean	Annual mean
Nitrogen deposition	-	Annual deposition
Acid deposition	-	Annual deposition

4.3.8 Predicted pollutant concentrations were summarised in the following formats:

- Process Contribution (PC) - Predicted pollutant concentration as a result of emissions from the facility only; and
- Predicted Environmental Concentration (PEC) - Total predicted pollutant concentration as a result of emissions from the facility and existing baseline levels.

4.3.9 Predicted ground level pollutant concentrations and deposition rates were compared with the relevant AQOs, critical levels and critical loads. These criteria are collectively referred to as Environmental Quality Standards (EQSs).

4.4 Assessment Area

4.4.1 The assessment area was defined based on the facility location, anticipated pollutant dispersion patterns and the positioning of sensitive receptors. Ambient concentrations were predicted over NGR: 470210, 104920 to 471710, 106420. One Cartesian grid with a resolution of 10m was used within the model to produce data suitable for contour plotting using the Surfer software package.

4.4.2 Reference should be made to Figure 4 for a graphical representation of the assessment grid extents.

4.5 Process Conditions

- 4.5.1 A summary of the inputs used in the assessment is provided in Table 13. These were obtained from the technical data sheet for the proposed generator sets, as provided by Conrad Energy (Developments) Limited.

Table 13 Process Conditions

Parameter	Unit	Value
Stack position	NGR	As shown on Figure 4
Stack height	m	7.00
Stack diameter	m	0.5
Exhaust gas temperature	°C	419
Exhaust gas moisture content	%	7.74
Exhaust gas flow rate	m ³ /hr	26,075
Exhaust gas flow rate (dry)	Nm ³ /hr	9,491
Exhaust gas efflux velocity	m/s	36.89

- 4.5.2 Reference should be made to Figure 4 for a map of the emission point locations.

4.6 Emissions

- 4.6.1 Anticipated pollutant concentrations in the exhaust gas stream from the generator sets were obtained from the technical data sheet provided by Conrad Energy (Developments) Limited. These are shown in Table 14.

Table 14 Pollutant Emission Concentration

Pollutant	Pollutant Emission Concentration (mg/Nm ³) (Dry, 5% Oxygen)
NO _x	250

- 4.6.2 The pollutant mass emission rates for use in the assessment were derived from the concentration shown in Table 14 and the flow rate shown in Table 13. The result is summarised in Table 15. It should be noted that identical emission rates were utilised for all generator sets.

Table 15 Pollutant Mass Emission Rate - Per Engine

Pollutant	Pollutant Mass Emission Rate (g/s)
NO _x	0.6591

4.7 NO_x to NO₂ Conversion

4.7.1 Emissions of total NO_x from combustion processes are predominantly in the form of nitric oxide (NO). Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO₂. Comparisons of ambient NO and NO₂ concentrations in the vicinity of point sources in recent years has indicated that it is unlikely that more than 30% of the NO_x is present at ground level as NO₂.

4.7.2 Ambient NO_x concentrations were predicted through dispersion modelling. Concentrations of NO₂ shown in the results section assume 70% conversion from NO_x to NO₂ for annual means and 35% conversion for 1-hour concentrations, based upon EA guidance¹⁵.

4.8 Building Effects

4.8.1 The dispersion of substances released from elevated sources can be influenced by the presence of buildings close to the emission point. Structures can interrupt the wind flows and cause significantly higher ground-level concentrations close to the source than would arise in the absence of the buildings.

4.8.2 Analysis of the site layout indicated that a number of structures should be included within the model in order to take account of effects on pollutant dispersion. Input geometries are shown in Table 16.

Table 16 Building Geometries

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	X	Y				
Generator 1	470926.1	105712.6	7.0	12.2	2.4	168.0

¹⁵ Environmental permitting: air dispersion modelling reports, EA, 2018.

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	X	Y				
Generator 2	470931.2	105713.7	7.0	12.2	2.4	168.2

4.9 **Meteorological Data**

4.9.1 Meteorological data used in the assessment was taken from Thorney Island meteorological station over the period 1st January 2014 to 31st December 2018 (inclusive). This observation station is located at NGR: 476521, 102593, which is approximately 8.7km south-east of the facility. 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.

4.9.2 All meteorological files used in the assessment were provided by Atmospheric Dispersion Modelling Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 for wind roses of utilised meteorological records.

4.10 **Roughness Length**

4.10.1 Roughness length (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. This is considered appropriate for the morphology of the area and is suggested within ADMS-5 as being suitable for 'parkland, open suburbia'.

4.10.2 A z_0 of 0.3m was used within the model to describe the meteorological site. This is considered appropriate for the morphology of the area and is suggested within ADMS-5 as being suitable for 'agricultural areas (max)'.

4.11 **Monin-Obukhov Length**

4.11.1 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-5 as being suitable for 'cities and large towns'.

- 4.11.2 A minimum Monin-Obukhov length of 1m was used to describe the meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-5 as being suitable for 'rural areas'.

4.12 Terrain Data

- 4.12.1 Ordnance Survey OS Terrain 50 data was included in the model for the site and surrounding area in order to take account of the specific flow field produced by variations in ground height throughout the assessment extents. This was pre-processed using the method suggested by CERC.

4.13 Nitrogen Deposition

- 4.13.1 Nitrogen deposition rates were calculated using the conversion factors provided within EA document 'Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06'¹⁶. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the speciated dry deposition flux. The conversion factors used for the determination of nitrogen deposition are presented within Table 17.

Table 17 Conversion Factors to Determine Dry Deposition Flux for Nitrogen Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor ($\mu\text{g}/\text{m}^2/\text{s}$ to $\text{kg}/\text{ha}/\text{yr}$ of pollutant species)
	Grassland	Forest	
NO ₂	0.0015	0.003	95.9

- 4.13.2 The relevant deposition velocity for each ecological receptor was selected from Table 17 based on the vegetation type present within the designation.

4.14 Acid Deposition

- 4.14.1 Predicted ground level NO₂ concentrations were converted to kilo-equivalent ion depositions ($\text{keq}/\text{ha}/\text{yr}$) for comparison with the critical load for acid deposition at each

¹⁶ Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2014.

of the identified ecological receptors. The conversion to units of equivalents, a measure of the potential acidifying effect of a species, was undertaken using the standard conversion factors shown in Table 18.

Table 18 Conversion Factors to Determine Dry Deposition Flux for Acid Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor ($\mu\text{g}/\text{m}^2/\text{s}$ to $\text{keq}/\text{ha}/\text{yr}$ of pollutant species)
	Grassland	Forest	
NO ₂	0.0015	0.003	6.84

4.14.2 The PC proportion of the EQS was calculated using the following formula obtained from the APIS website¹⁷:

$$\text{PC as \%CL function} = ((\text{PC of N deposition})/\text{CLmaxN}) * 100$$

4.15 Background Concentrations

4.15.1 Review of existing data in the vicinity of the site was undertaken Section 3.3 in order to identify suitable background values for use in the assessment. This indicated that the 7(B) - Brockhampton Lane monitor is positioned approximately 400m north-east of the site. As such, the most recent recorded annual mean concentration of $25.28\mu\text{g}/\text{m}^3$ was utilised as the NO₂ background value. This was higher than the DEFRA predicted concentration and therefore allowed a worst-case assessment.

4.15.2 Baseline pollutant levels at the ecological receptors were obtained from the DEFRA and APIS websites, as summarised in Table 10.

4.15.3 It is not possible to add short-term peak baseline and process concentrations. This is because the conditions which give rise to peak ground-level concentrations of substances emitted from an elevated source at a particular location and time are likely to be different to the conditions which give rise to peak concentrations due to emissions from other sources. This point is addressed in in EA guidance 'Air emissions risk assessment for your environmental permit'¹⁸, which advises that an estimate of the maximum

¹⁷ <http://www.apis.ac.uk/>.

¹⁸ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

combined pollutant concentration can be obtained by adding the maximum predicted short-term concentration due to emissions from the source to twice the annual mean baseline concentration. This approach was adopted throughout the assessment.

4.16 **Assessment Criteria**

Human Receptors

4.16.1 The significance of predicted air quality impacts at sensitive human receptors was determined in accordance with the guidance provided within the Institute of Air Quality Management (IAQM) document 'Land-Use Planning & Development Control: Planning for Air Quality'¹⁹. Using this methodology impacts are defined based on the interaction between the predicted pollutant concentration with the development in place (PEC) and the magnitude of change (PC), as outlined in Table 19.

Table 19 Significance of Impact

Concentration at Receptor in Assessment Year (PEC)	Predicted Concentration Change as Proportion of EQS (PC) (%)			
	1	2 - 5	6 - 10	> 10
75% or less of EQS	Negligible	Negligible	Slight	Moderate
76 - 94% of EQS	Negligible	Slight	Moderate	Moderate
95 - 102% of EQS	Slight	Moderate	Moderate	Substantial
103 - 109% of EQS	Moderate	Moderate	Substantial	Substantial
110% or more of EQS	Moderate	Substantial	Substantial	Substantial

4.16.2 The matrix shown in Table 19 is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which makes it clearer which cell the impact falls within. It should be noted that changes of 0%, i.e. less than 0.5%, are described as **negligible**.

4.16.3 Following the prediction of impacts at discrete receptor locations, the IAQM document²⁰ provides guidance on determining the overall air quality impact significance of the

¹⁹ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

²⁰ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

operation of a development and states that an assessment must reach a conclusion on the likely significance of the predicted impact. It should be noted that this is a binary judgement of either **significant** or **not significant**. The determination of significance relies on professional judgement and reasoning has been provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts.

- 4.16.4 It should be noted the above methodology is only suitable for predicting impacts at locations sensitive to changes in long term pollution levels. As such, significance has not been assigned to changes in short-term concentrations.

Ecological Receptors

- 4.16.5 EA guidance 'Air emissions risk assessment for your environmental permit'²¹ states that PCs at SPAs, SACs, Ramsar sites and SSSIs can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard for protected conservation areas;
- The long-term PC is less than 1% of the long-term environmental standard for protected conservation areas; or,
- The long-term PC is greater than 1% and the long term PEC is less than 70% of the long term environmental standard.

- 4.16.6 For LNRs, LWSs and ancient woodland, PCs can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 100% of the long-term environmental standard; and,
- The long-term PC is less than 100% of the long-term environmental standard.

- 4.16.7 Predicted PCs have been compared to the relevant EQSs and the criteria stated above. Where the impact is within these parameters, the EA concludes that impacts associated with an installation are acceptable.

²¹ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

4.17 Modelling Uncertainty

4.17.1 Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emission estimates, operational procedures, land use characteristics and meteorology; and,
- Variability - randomness of measurements used.

4.17.2 Potential uncertainties in the model results were minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS-5 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Meteorological data - Modelling was undertaken using five annual meteorological data sets from the closest observation station to the site. The analysis was based on the worst-case year for each averaging period to ensure maximum concentrations were considered;
- Surface characteristics - The z_0 and Monin-Obukhov length were determined for both the dispersion and meteorological sites based on the surrounding land uses and guidance provided by CERC;
- Plant operating conditions - Operational parameters were obtained from the technical data sheet for the generators. As such, these are considered to be representative of normal operating conditions;
- Emission rates - The emission rates were derived from the relevant generator specification. As such, these are considered to be representative of maximum releases;
- Background concentrations - Background pollutant levels were obtained from local monitoring data and the DEFRA and APIS websites;
- Receptor locations - A Cartesian Grid was included in the model in order to provide suitable data for contour plotting. Receptor points were also included at sensitive locations to provide additional consideration of these areas; and,

- Variability - All model inputs were as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

4.17.3 Results were considered in the context of the relevant EQSs and IAQM or EA significance criteria. It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

5.0 **RESULTS**

5.1 **Introduction**

- 5.1.1 Dispersion modelling was undertaken with the inputs described in Section 4.0. The results are outlined in the following Sections.
- 5.1.2 Reference should be made to Figure 6 and Figure 7 for graphical representations of predicted PECs, inclusive of background, throughout the assessment extents. It should be noted that the values shown in the Figures are predictions from the meteorological data set which resulted in the maximum pollutant concentration for that averaging period. For example, the maximum annual mean NO₂ concentration was predicted using the 2015 meteorological data set. As such, the contours shown in Figure 6 were produced from the 2015 model outputs.

5.2 **Maximum Pollutant Concentrations**

- 5.2.1 The maximum predicted pollutant concentrations at any point within the modelling extents for any meteorological data set are summarised in Table 20.

Table 20 Maximum Predicted Pollutant Concentrations

Pollutant	Averaging Period	EQS (µg/m ³)	PC (µg/m ³)	PC Proportion of EQS (%)	PEC (µg/m ³)	PEC Proportion of EQS (%)
NO ₂	Annual	40	5.35	13.4	30.63	76.6
	99.63 rd %ile 1-hour	200	45.45	22.7	96.01	48.0

- 5.2.2 As shown in Table 20, there were no predicted exceedences of any EQS at any location for any pollutant or averaging period of interest.

5.3 **Human Receptors**

- 5.3.1 Predicted annual mean NO₂ PECs at the sensitive human receptors, inclusive of background levels, are summarised in Table 21.

Table 21 Predicted Annual Mean NO₂ Concentrations

Receptor		Predicted Annual Mean NO ₂ PEC (µg/m ³)				
		2014	2015	2016	2017	2018
R1	Residential - The Mallards	25.40	25.39	25.40	25.42	25.40
R2	Residential - Brookmead Way	25.43	25.44	25.44	25.50	25.44
R3	Residential - Langbrook Close	25.47	25.49	25.49	25.57	25.49
R4	Residential - Longcroft Way	25.48	25.45	25.45	25.46	25.45
R5	The Wendy House Day Nursery, Brockhampton Road	25.47	25.46	25.44	25.45	25.45
R6	Residential - West Street	25.41	25.44	25.42	25.43	25.42
R7	Residential - Brockhampton Road	25.59	25.55	25.54	25.56	25.54
R8	Residential - Mill Lane	25.37	25.34	25.36	25.36	25.35

5.3.2 As indicated in Table 21, NO₂ PECs were below the annual mean EQS of 40µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.3.3 Reference should be made to Figure 6 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.4 The significance of predicted impacts on annual mean NO₂ concentrations at the sensitive receptors are summarised in Table 22. These consider the maximum predicted change in concentration from the five meteorological datasets as a worst-case.

Table 22 Predicted Impacts on Annual Mean NO₂ Concentrations

Receptor		Predicted Concentration (PEC)	Predicted Concentration Change as Proportion of EQS (PC) (%)	Impact Significance
R1	Residential - The Mallards	Below 75% of EQS	0	Negligible
R2	Residential - Brookmead Way	Below 75% of EQS	1	Negligible
R3	Residential - Langbrook Close	Below 75% of EQS	1	Negligible
R4	Residential - Longcroft Way	Below 75% of EQS	0	Negligible

Receptor		Predicted Concentration (PEC)	Predicted Concentration Change as Proportion of EQS (PC) (%)	Impact Significance
R5	The Wendy House Day Nursery, Brockhampton Road	Below 75% of EQS	0	Negligible
R6	Residential - West Street	Below 75% of EQS	0	Negligible
R7	Residential - Brockhampton Road	Below 75% of EQS	1	Negligible
R8	Residential - Mill Lane	Below 75% of EQS	0	Negligible

5.3.5 As indicated in Table 22, impacts on annual mean NO₂ concentrations as a result of the proposed development were predicted to be **negligible** at all sensitive receptors. As such, overall impacts are considered to be **not significant**.

5.3.6 Predicted 99.63rd %ile 1-hour mean NO₂ PECs, inclusive of background levels, are summarised in Table 23.

Table 23 Predicted 99.63rd %ile 1-hour Mean NO₂ Concentrations

Receptor		Predicted 99.63 rd %ile 1-hour Mean NO ₂ PEC (µg/m ³)				
		2014	2015	2016	2017	2018
R1	Residential - The Mallards	53.86	53.99	54.01	54.17	54.02
R2	Residential - Brookmead Way	54.36	54.48	54.65	54.67	54.40
R3	Residential - Langbrook Close	54.70	54.79	54.96	55.03	54.55
R4	Residential - Longcroft Way	54.90	54.92	55.01	55.08	55.25
R5	The Wendy House Day Nursery, Brockhampton Road	54.14	54.05	53.92	53.93	53.94
R6	Residential - West Street	53.16	53.11	53.23	53.33	53.27
R7	Residential - Brockhampton Road	56.26	56.17	56.13	56.12	56.14
R8	Residential - Mill Lane	53.79	53.11	53.55	53.35	53.37

5.3.7 As indicated in Table 23, 1-hour mean NO₂ PECs were below the EQS of 200µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.3.8 Reference should be made to Figure 7 for a graphical representation of predicted concentrations throughout the assessment extents. This indicates that the development is not predicted to cause EQS exceedences at any location.

5.3.9 As stated previously, the IAQM methodology provided in Section 4.16 is for the determination of the significance of annual mean impacts only. However, as there are no predicted 1-hour mean EQS exceedences at any receptor location for any meteorological data set, impacts are considered to be **not significant**.

5.4 Ecological Receptors

Nitrogen Oxides

5.4.1 Predicted annual mean NO_x PECs at the ecological receptor locations, inclusive of background levels, are summarised in Table 24.

Table 24 Predicted Annual Mean NO_x Concentrations

Receptor	Predicted Annual Mean NO _x PEC (µg/m ³)				
	2014	2015	2016	2017	2018
E1	28.13	28.12	28.12	28.12	28.13
E2	34.83	34.82	34.83	34.82	34.84
E3	18.89	18.87	18.89	18.88	18.88
E4	17.61	17.60	17.61	17.60	17.61
E5	31.82	31.81	31.85	31.76	32.02
E6	29.06	29.01	29.05	29.06	29.04
E7	19.57	19.59	19.58	19.56	19.56
E8	18.88	18.87	18.88	18.88	18.88
E9	28.98	28.98	28.99	29.01	28.97
E10	29.00	29.01	29.02	29.08	29.00
E11	26.92	26.97	26.93	26.94	26.88
E12	34.84	34.83	34.84	34.83	34.85
E13	28.15	28.14	28.14	28.14	28.15

Receptor	Predicted Annual Mean NO _x PEC (µg/m ³)				
	2014	2015	2016	2017	2018
E14	28.13	28.12	28.13	28.12	28.13
E15	28.13	28.12	28.12	28.12	28.13
E16	25.09	25.08	25.08	25.08	25.09
E17	22.50	22.50	22.51	22.54	22.50
E18	31.64	31.60	31.66	31.53	31.65

5.4.2 As indicated in Table 24, annual mean NO_x PECs were below the EQS of 30µg/m³ at 15 receptors and above at 3 locations. It should be noted that the exceedences are partly due to the high baseline levels at a number of designations.

5.4.3 Maximum predicted annual mean NO_x concentrations at the ecological receptor locations are summarised in Table 25.

Table 25 Maximum Predicted Annual Mean NO_x Concentrations

Receptor		Maximum Predicted Annual Mean NO _x Concentration (µg/m ³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Ancient Woodland	0.02	28.13	0.1	93.8
E2	Farlington Marshes LNR, Chichester and Langstone Harbour Ramsar	0.05	34.84	0.2	116.1
E3	West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSI	0.06	18.89	0.2	63.0
E4	Hayling Billy LNR, Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	0.04	17.61	0.1	58.7
E5	Mudflats - Protected Habitat	0.63	32.02	2.1	106.7
E6	Southmoor Reserve LWS	0.18	29.06	0.6	96.9
E7	Southmoor - Big Field (south edge) LWS	0.13	19.59	0.4	65.3

Receptor		Maximum Predicted Annual Mean NO _x Concentration (µg/m ³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E8	Hayling Billy Line LWS, West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSSI	0.05	18.88	0.2	62.9
E9	Langstone Mill Pond LWS	0.12	29.01	0.4	96.7
E10	Wade Court Park LWS	0.19	29.08	0.6	96.9
E11	St Faiths Church Yard LWS	0.24	26.97	0.8	89.9
E12	Farlington Marshes Grassland LWS	0.06	34.85	0.2	116.2
E13	Fields off Havant Road LWS	0.04	28.15	0.1	93.8
E14	Camp Down Grassland Remnants LWS	0.03	28.13	0.1	93.8
E15	Pyecroft's Meadow LWS	0.02	28.13	0.1	93.8
E16	Littlewood Park (east) LWS	0.02	25.09	0.1	83.6
E17	Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	0.12	22.54	0.4	75.1
E18	Chichester and Langstone Harbour Ramsar and SPA, Langstone Harbour SSSI, Solent & Isle of Wight Lagoons SAC	0.27	31.66	0.9	105.5

5.4.4 As shown in Table 25, PCs were below 1% of the EQS at all SPAs, SACs, Ramsars and SSSIs and 100% of the EQS at all LNRs, LWSs and ancient woodland. As such, predicted effects on annual mean NO_x concentrations are considered to be **not significant**, in accordance with the stated criteria.

5.4.5 Predicted 24-hour mean NO_x PECs at the receptor locations, inclusive of background levels, are summarised in Table 26.

Table 26 Predicted 24-hour Mean NO_x Concentrations

Receptor	Predicted 24-hour Mean NO _x PEC (µg/m ³)				
	2014	2015	2016	2017	2018
E1	56.84	56.79	56.94	56.90	57.52
E2	70.80	70.64	71.18	70.90	71.39
E3	39.29	39.33	40.36	39.33	39.34
E4	36.32	36.48	37.32	36.28	36.60
E5	80.09	79.04	79.21	81.98	93.18
E6	66.59	63.23	65.21	63.79	63.55
E7	43.53	44.35	43.78	43.32	44.36
E8	39.12	39.23	40.23	39.05	39.35
E9	60.54	60.19	60.01	60.47	60.08
E10	61.22	60.81	60.81	61.12	61.72
E11	56.62	56.59	56.88	56.39	57.58
E12	71.25	71.16	71.24	71.44	71.71
E13	57.49	57.84	57.59	57.87	57.86
E14	57.03	57.11	56.98	57.26	57.32
E15	56.84	57.09	56.96	57.06	57.28
E16	50.75	50.67	50.85	50.69	51.36
E17	47.29	46.81	47.28	47.38	47.35
E18	70.77	70.35	70.46	69.13	69.30

5.4.6 As indicated in Table 26, predicted 24-hour mean NO_x concentrations were below the EQS of 30µg/m³ at 17 receptors and above at 1 location. It should be noted that the exceedence is partly due to the high baseline level.

5.4.7 Maximum predicted 24-hour mean NO_x concentrations at the receptor locations are summarised in Table 27.

Table 27 Maximum Predicted 24-hour Mean NO_x Concentrations

Receptor		Maximum Predicted 24-hour Mean NO _x Concentration (µg/m ³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Ancient Woodland	1.30	57.52	1.7	76.7
E2	Farlington Marshes LNR, Chichester and Langstone Harbour Ramsar	1.82	71.39	2.4	95.2
E3	West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSI	2.69	40.36	3.6	53.8
E4	Hayling Billy LNR, Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	2.19	37.32	2.9	49.8
E5	Mudflats - Protected Habitat	30.41	93.18	40.5	124.2
E6	Southmoor Reserve LWS	8.81	66.59	11.7	88.8
E7	Southmoor - Big Field (south edge) LWS	5.44	44.36	7.3	59.1
E8	Hayling Billy Line LWS, West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSSI	2.57	40.23	3.4	53.6
E9	Langstone Mill Pond LWS	2.77	60.54	3.7	80.7
E10	Wade Court Park LWS	3.94	61.72	5.3	82.3
E11	St Faiths Church Yard LWS	4.12	57.58	5.5	76.8
E12	Farlington Marshes Grassland LWS	2.13	71.71	2.8	95.6
E13	Fields off Havant Road LWS	1.66	57.87	2.2	77.2
E14	Camp Down Grassland Remnants LWS	1.10	57.32	1.5	76.4
E15	Pyecroft's Meadow LWS	1.06	57.28	1.4	76.4
E16	Littlewood Park (east) LWS	1.22	51.36	1.6	68.5
E17	Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	2.53	47.38	3.4	63.2
E18	Chichester and Langstone Harbour Ramsar and SPA, Langstone Harbour SSSI, Solent & Isle of Wight Lagoons SAC	8.00	70.77	10.7	94.4

5.4.8 As shown in Table 27, PCs were below 1% of the EQS at all SPAs, SACs, Ramsars and SSSIs and 100% of the EQS at all LNRs, LWSs and ancient woodland, with the exception of E18. However, the EQS is predicted to be achieved at this location. As such, predicted effects on 24-hour mean NO_x concentrations are considered to be **not significant**, in accordance with the stated criteria.

Nitrogen Deposition

5.4.9 Predicted annual nitrogen PC deposition rates at the ecological receptor locations are summarised in Table 28.

Table 28 Predicted Annual Nitrogen Deposition Rates

Receptor	Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)				
	2014	2015	2016	2017	2018
E1	0.004	0.002	0.003	0.003	0.005
E2	0.004	0.003	0.004	0.003	0.005
E3	0.006	0.004	0.005	0.005	0.005
E4	0.004	0.003	0.004	0.004	0.004
E5	0.044	0.043	0.047	0.038	0.064
E6	0.018	0.012	0.016	0.017	0.016
E7	0.012	0.013	0.012	0.010	0.010
E8	0.005	0.004	0.005	0.005	0.005
E9	0.018	0.018	0.020	0.024	0.018
E10	0.024	0.025	0.026	0.038	0.023
E11	0.038	0.048	0.041	0.042	0.030
E12	0.005	0.004	0.005	0.005	0.006
E13	0.004	0.003	0.003	0.003	0.004
E14	0.003	0.002	0.002	0.002	0.003
E15	0.002	0.001	0.002	0.001	0.002
E16	0.003	0.002	0.002	0.003	0.004

Receptor	Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)				
	2014	2015	2016	2017	2018
E17	0.016	0.016	0.018	0.024	0.016
E18	0.051	0.044	0.055	0.030	0.054

5.4.10 Maximum predicted annual nitrogen deposition rates at the receptor locations are summarised in Table 29.

Table 29 Maximum Predicted Annual Nitrogen Deposition Rates

Receptor		Maximum Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)	Proportion of EQS (%)	
			Low EQS	High EQS
E1	Ancient Woodland	0.005	0.0	0.0
E2	Farlington Marshes LNR, Chichester and Langstone Harbour Ramsar	0.005	0.0	0.0
E3	West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSI	0.006	0.1	0.0
E4	Hayling Billy LNR, Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	0.004	0.1	0.0
E5	Mudflats - Protected Habitat	0.064	0.3	0.2
E6	Southmoor Reserve LWS	0.018	0.1	0.1
E7	Southmoor - Big Field (south edge) LWS	0.013	0.1	0.0
E8	Hayling Billy Line LWS, West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSSI	0.005	0.1	0.0
E9	Langstone Mill Pond LWS	0.024	0.2	0.1
E10	Wade Court Park LWS	0.038	0.4	0.2
E11	St Faiths Church Yard LWS	0.048	0.5	0.2
E12	Farlington Marshes Grassland LWS	0.006	0.0	0.0
E13	Fields off Havant Road LWS	0.004	0.0	0.0

Receptor		Maximum Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)	Proportion of EQS (%)	
			Low EQS	High EQS
E14	Camp Down Grassland Remnants LWS	0.003	0.0	0.0
E15	Pyecroft's Meadow LWS	0.002	0.0	0.0
E16	Littlewood Park (east) LWS	0.004	0.0	0.0
E17	Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	0.024	0.3	0.2
E18	Chichester and Langstone Harbour Ramsar and SPA, Langstone Harbour SSSI, Solent & Isle of Wight Lagoons SAC	0.055	0.3	0.2

5.4.11 As shown in Table 29, PCs were below 1% of the EQS at all SPAs, SACs, Ramsars and SSSIs and 100% of the EQS at all LNRs, LWSs and ancient woodland. As such, predicted impacts on annual nitrogen deposition at ecological receptors are considered to be **not significant**.

Acid Deposition

5.4.12 Predicted annual acid PC deposition rates are summarised in Table 30.

Table 30 Predicted Annual PC Acid Deposition Rates

Receptor	Predicted Annual PC Acid Deposition Rate (keq/ha/yr)				
	2014	2015	2016	2017	2018
E1	0.0003	0.0002	0.0002	0.0002	0.0003
E2	0.0003	0.0002	0.0003	0.0002	0.0004
E3	0.0004	0.0003	0.0004	0.0004	0.0004
E4	0.0003	0.0002	0.0003	0.0003	0.0003
E5	0.0031	0.0031	0.0034	0.0027	0.0045
E6	0.0013	0.0009	0.0012	0.0012	0.0011
E7	0.0008	0.0009	0.0009	0.0007	0.0007

Receptor	Predicted Annual PC Acid Deposition Rate (keq/ha/yr)				
	2014	2015	2016	2017	2018
E8	0.0004	0.0003	0.0003	0.0003	0.0003
E9	0.0013	0.0013	0.0014	0.0017	0.0013
E10	0.0017	0.0018	0.0019	0.0027	0.0017
E11	0.0027	0.0034	0.0029	0.0030	0.0021
E12	0.0004	0.0003	0.0003	0.0003	0.0004
E13	0.0003	0.0002	0.0002	0.0002	0.0003
E14	0.0002	0.0001	0.0001	0.0001	0.0002
E15	0.0002	0.0001	0.0001	0.0001	0.0002
E16	0.0002	0.0002	0.0002	0.0002	0.0003
E17	0.0012	0.0012	0.0013	0.0017	0.0011
E18	0.0037	0.0032	0.0039	0.0021	0.0039

5.4.13 Maximum predicted annual acid deposition rates at the receptor locations are summarised in Table 31.

Table 31 Predicted Annual Acid Deposition Rates

Receptor		Maximum Predicted Annual Acid PC Deposition Rate (keq/ha/yr)	Proportion of EQS (%)
E1	Ancient Woodland	0.0003	0.0
E2	Farlington Marshes LNR, Chichester and Langstone Harbour Ramsar	0.0004	-
E3	West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSI	0.0004	0.1
E4	Hayling Billy LNR, Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	0.0003	0.0
E5	Mudflats - Protected Habitat	0.0045	-
E6	Southmoor Reserve LWS	0.0013	-

Receptor		Maximum Predicted Annual Acid PC Deposition Rate (keq/ha/yr)	Proportion of EQS (%)
E7	Southmoor - Big Field (south edge) LWS	0.0009	-
E8	Hayling Billy Line LWS, West Hayling LNR, Chichester and Langstone Harbour Ramsar and SPA, Solent Maritime SAC, Langstone Harbour SSSI	0.0004	0.1
E9	Langstone Mill Pond LWS	0.0017	0.0
E10	Wade Court Park LWS	0.0027	0.0
E11	St Faiths Church Yard LWS	0.0034	0.0
E12	Farlington Marshes Grassland LWS	0.0004	0.0
E13	Fields off Havant Road LWS	0.0003	0.0
E14	Camp Down Grassland Remnants LWS	0.0002	0.0
E15	Pyecroft's Meadow LWS	0.0002	0.0
E16	Littlewood Park (east) LWS	0.0003	0.0
E17	Chichester and Langstone Harbour Ramsar and SPA, Chichester Harbour SSSI, Solent Maritime SAC	0.0017	0.3
E18	Chichester and Langstone Harbour Ramsar and SPA, Langstone Harbour SSSI, Solent & Isle of Wight Lagoons SAC	0.0039	-

5.4.14 As shown in Table 31, PCs were below 1% of the EQS at all SPAs, SACs, Ramsars and SSSIs and 100% of the EQS at all LNRs, LWSs and ancient woodland. As such, predicted impacts on annual acid deposition at ecological receptors are considered to be **not significant**.

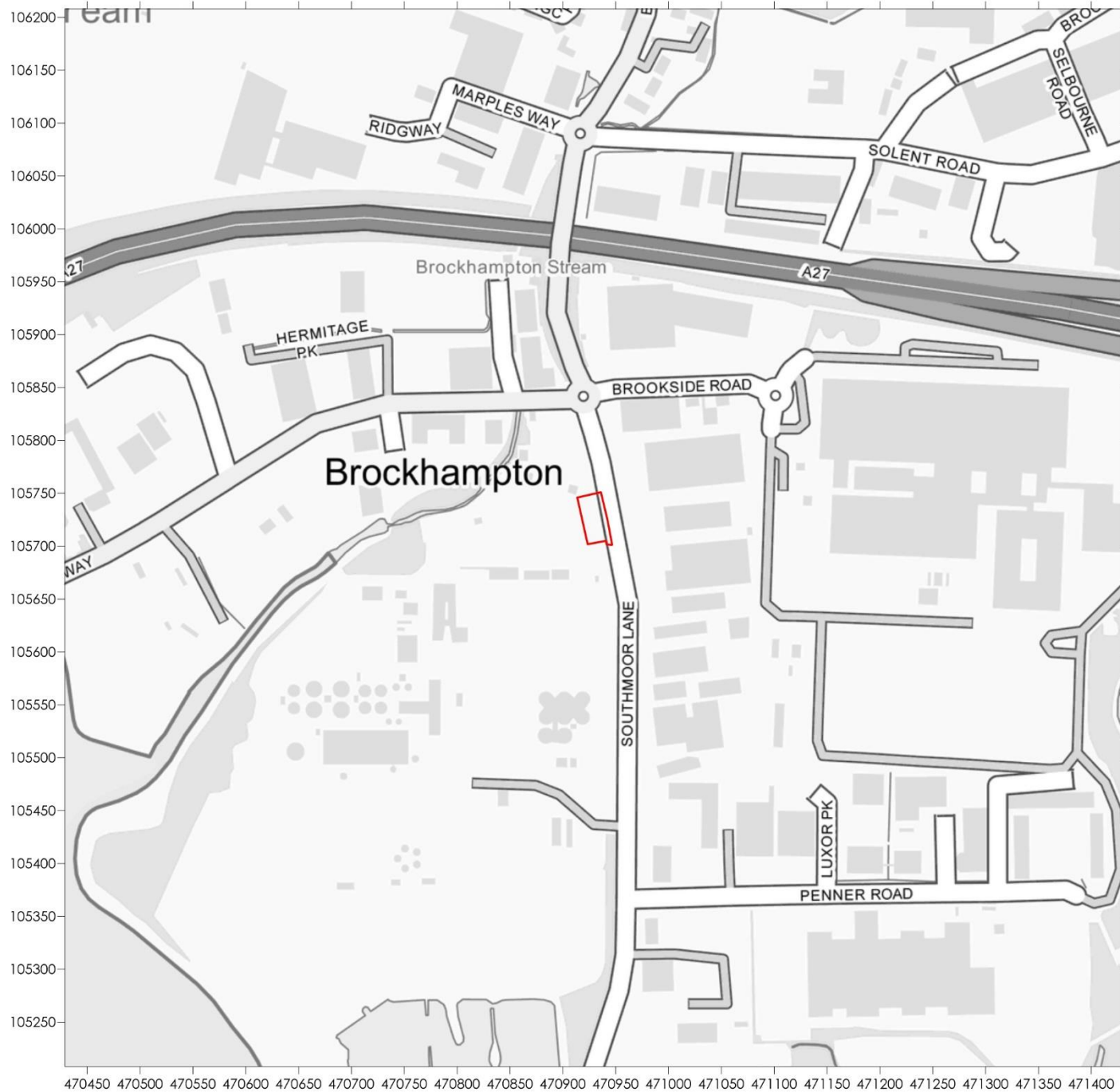
6.0 CONCLUSION

- 6.1.1 Redmore Environmental Ltd was commissioned by Conrad Energy (Developments) Limited to undertake an Air Quality Assessment in support of a planning application for the erection of a flexible generation facility with associated ancillary infrastructure, access and boundary treatment, on land off Southmoor Lane, Langstone.
- 6.1.2 Combustion emissions from the facility have the potential to cause air quality impacts during normal operation. An Air Quality Assessment was therefore undertaken in order to determine baseline conditions and consider potential effects.
- 6.1.3 Dispersion modelling was undertaken in order to predict pollutant concentrations at sensitive locations as a result of emissions from the plant. Impacts at sensitive receptors were quantified and the results compared with the relevant EQSs and significance criteria.
- 6.1.4 Predicted concentrations of all pollutants were below the relevant EQSs at all locations of human exposure for all meteorological data sets modelled. Review of the dispersion modelling results also indicated that impacts on annual mean NO₂ concentrations were predicted to be **negligible** at all receptors and there were no predicted 1-hour mean EQS exceedences at any location. As such, overall impacts are considered to be **not significant**.
- 6.1.5 Impacts at relevant ecological sites were also predicted to be **not significant** at all identified designations.
- 6.1.6 Based on the assessment results, air quality issues are not considered a constraint to planning consent for the proposal.

7.0 **ABBREVIATIONS**

APIS	Air Pollution Information System
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
ELV	Emission Limit Value
EQS	Environmental Quality Standard
HBC	Havant Borough Council
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LNR	Local Nature Reserve
LWS	Local Wildlife Site
MAGIC	Multi-Agency Geographic Information for the Countryside
NGR	National Grid Reference
NO	Nitric oxide
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
PC	Process Contribution
PEC	Predicted Environmental Concentration
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
Z ₀	Roughness length
%ile	Percentile

Figures



Legend



Site Boundary

Title

Figure 1 - Site Location Plan

Project

Air Quality Assessment
Langstone Flexible Generation
Facility

Project Reference

3815-3

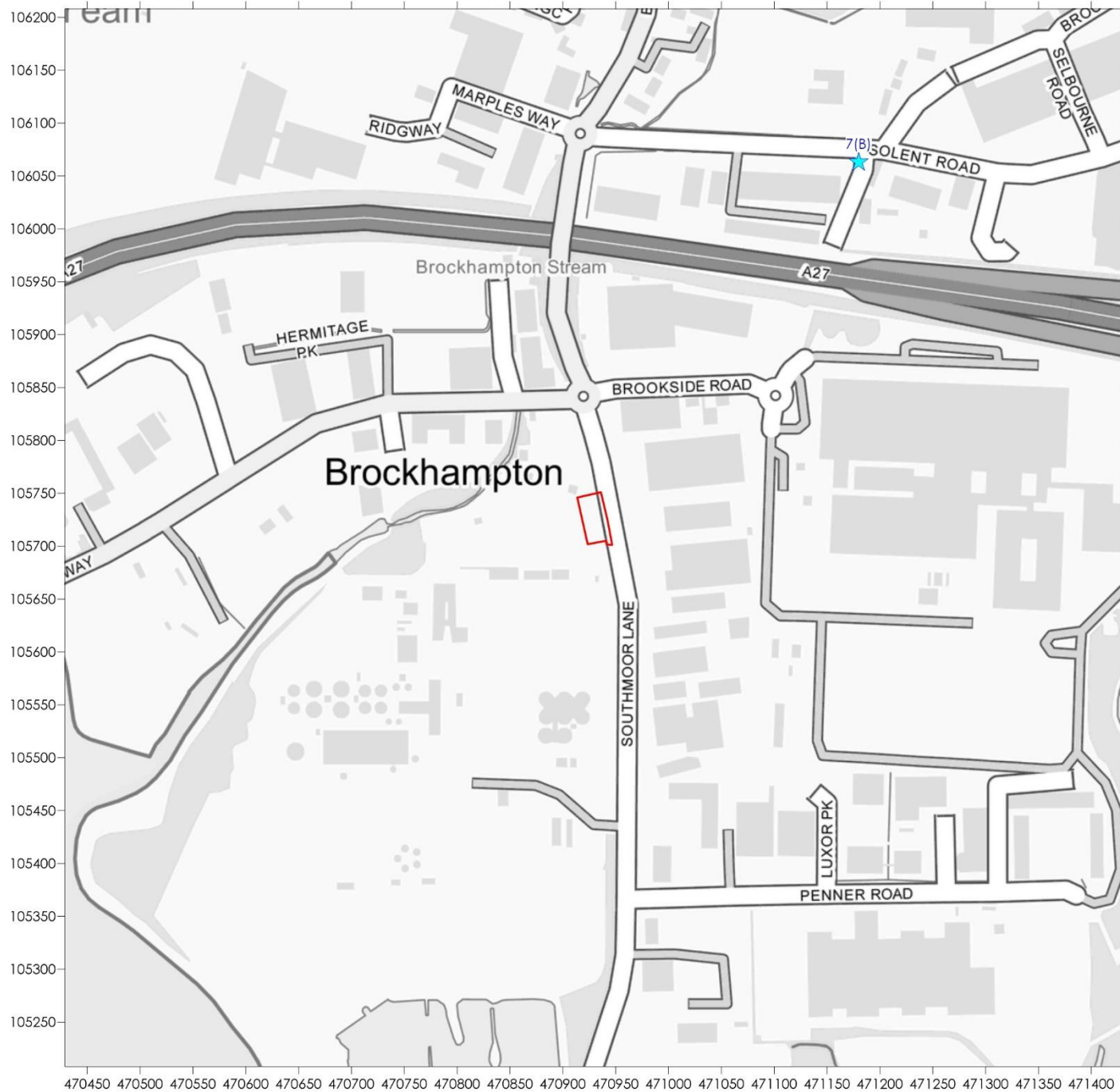
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Legend



Site Boundary



Monitor

Title

Figure 2 - Monitoring Location

Project

Air Quality Assessment
Langstone Flexible Generation
Facility

Project Reference

3815-3

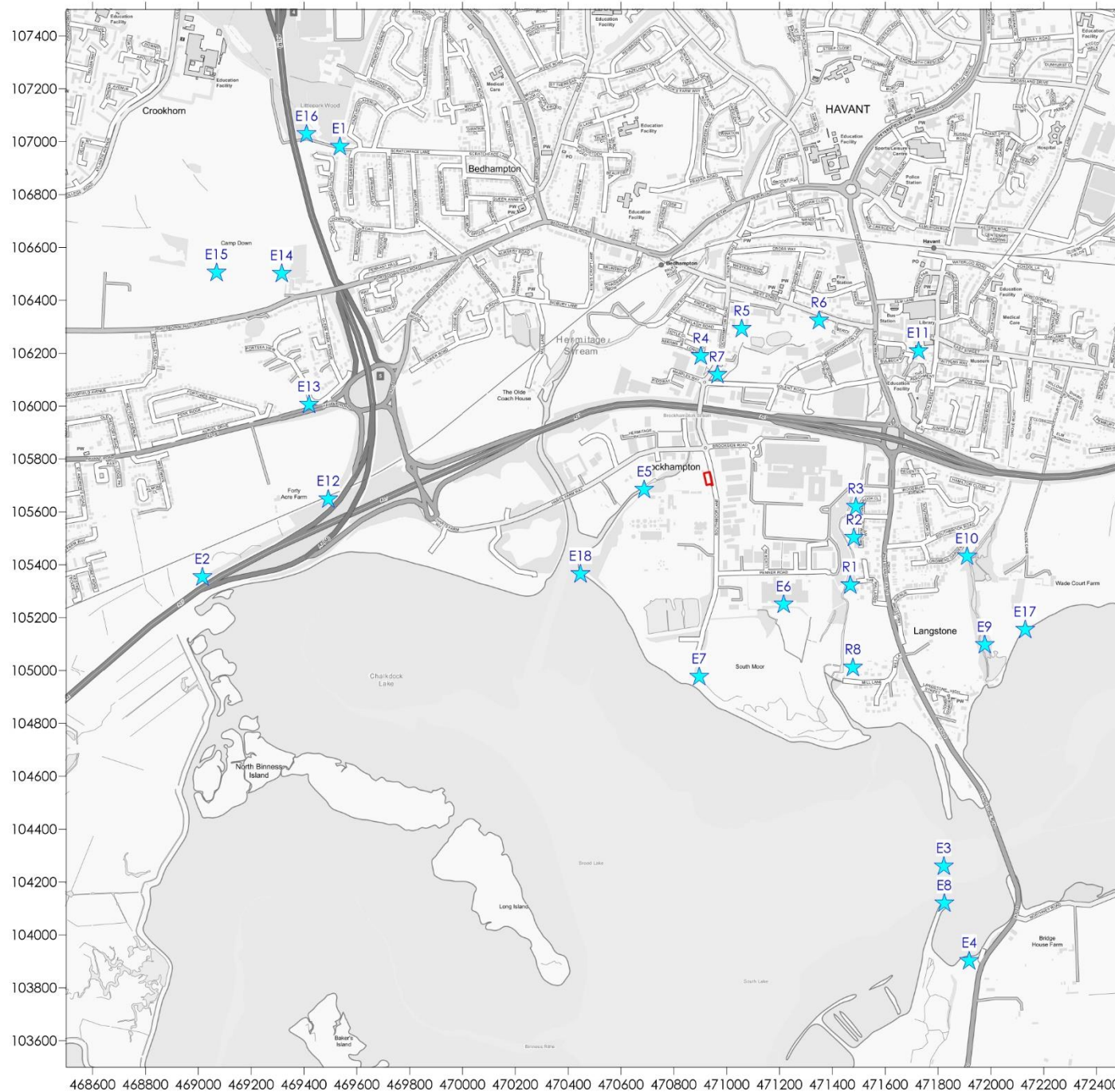
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Site Boundary



Receptor

Title

Figure 3 - Sensitive Receptor Locations

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Air Quality Assessment
Langstone Flexible Generation Facility

Project Reference

3815-3

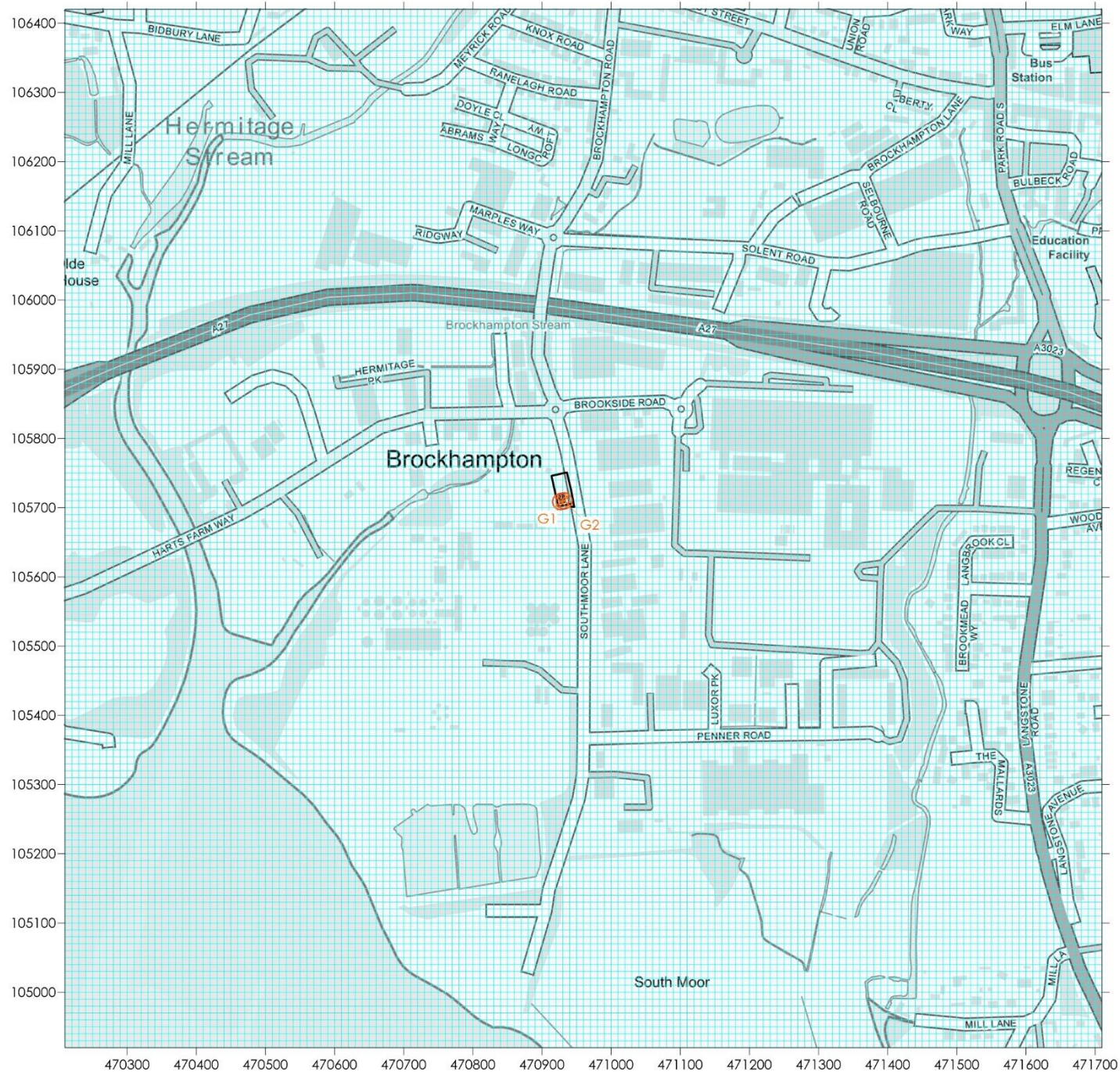
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Legend

-  Site Boundary
-  Stack
-  Assessment Grid
-  Building

Title

Figure 4 - ADMS-5 Inputs

Project

Air Quality Assessment
Langstone Flexible Generation
Facility

Project Reference

3815-3

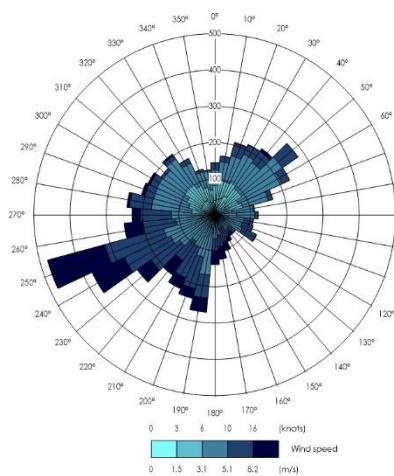
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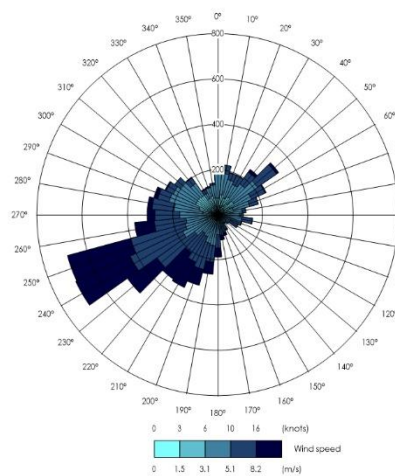
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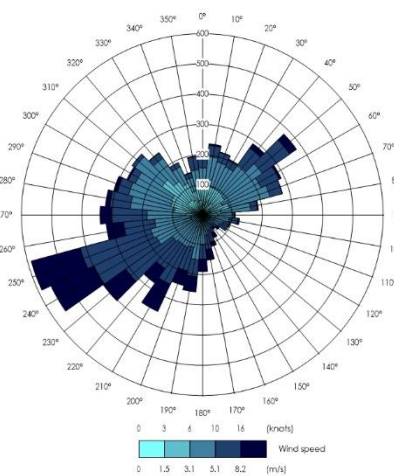
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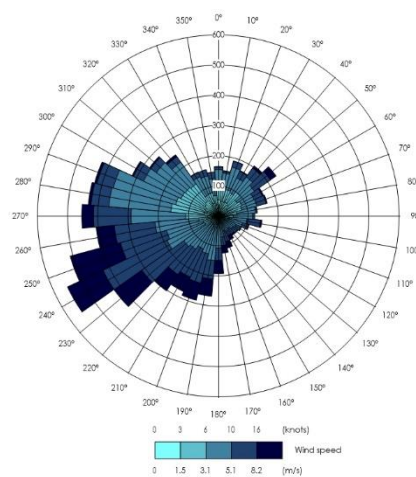
2014 Meteorological Data



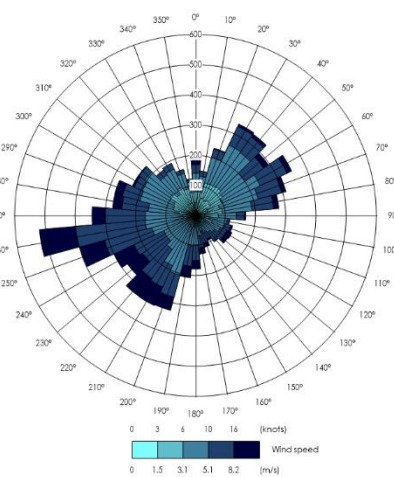
2015 Meteorological Data



2016 Meteorological Data



2017 Meteorological Data



2018 Meteorological Data

Legend

Title

Figure 5 - Wind Roses of 2014 to 2018
Thorney Island Meteorological Data

Project

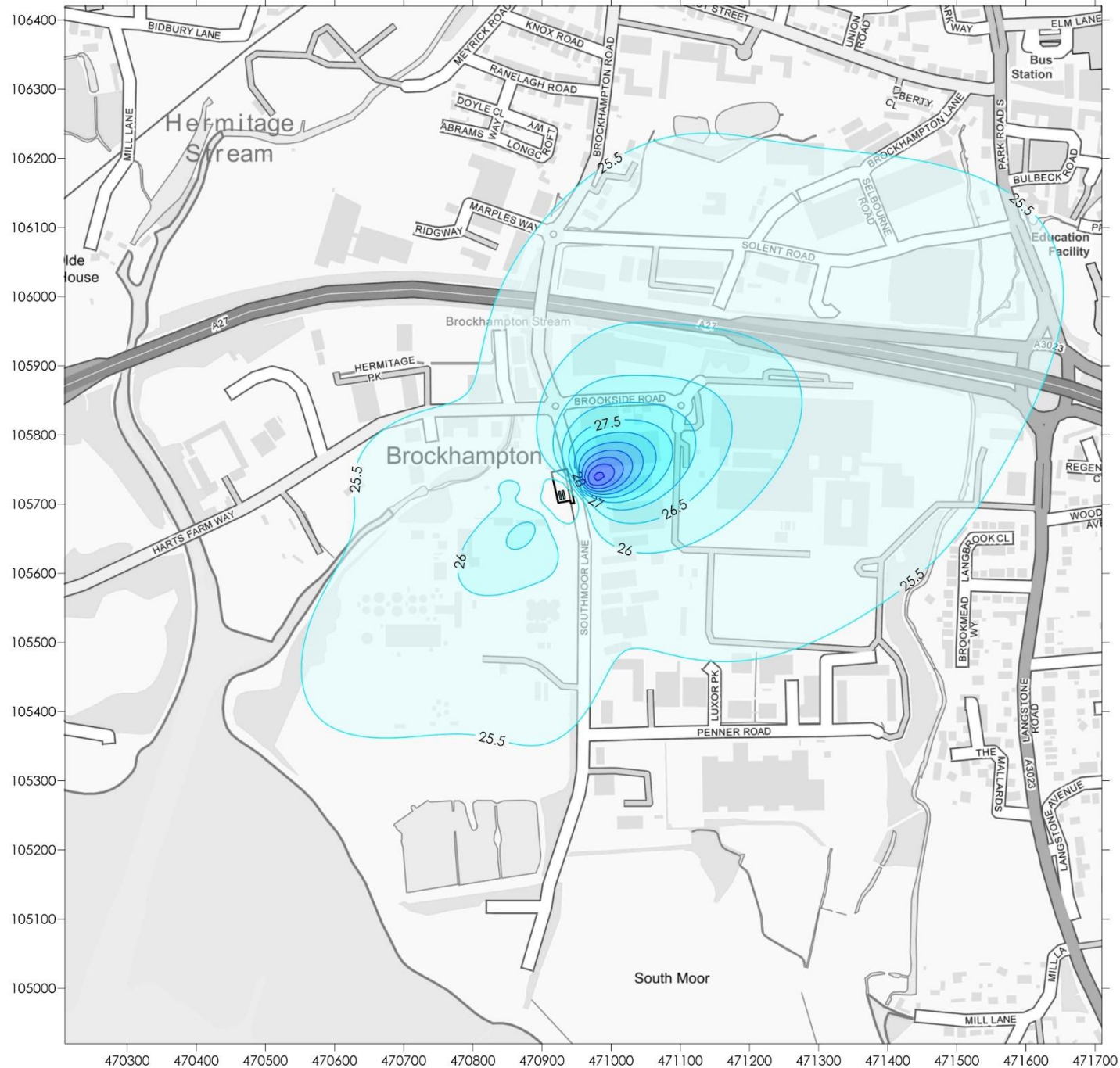
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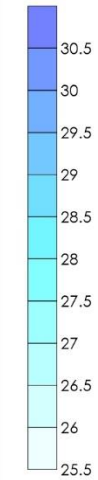
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Site Boundary



Annual Mean NO₂
Concentration
(µg/m³)

Title

Figure 6 - Predicted Annual Mean
NO₂ Concentration (µg/m³)
2015 Meteorological Data

Project

Air Quality Assessment
Langstone Flexible Generation
Facility

Project Reference

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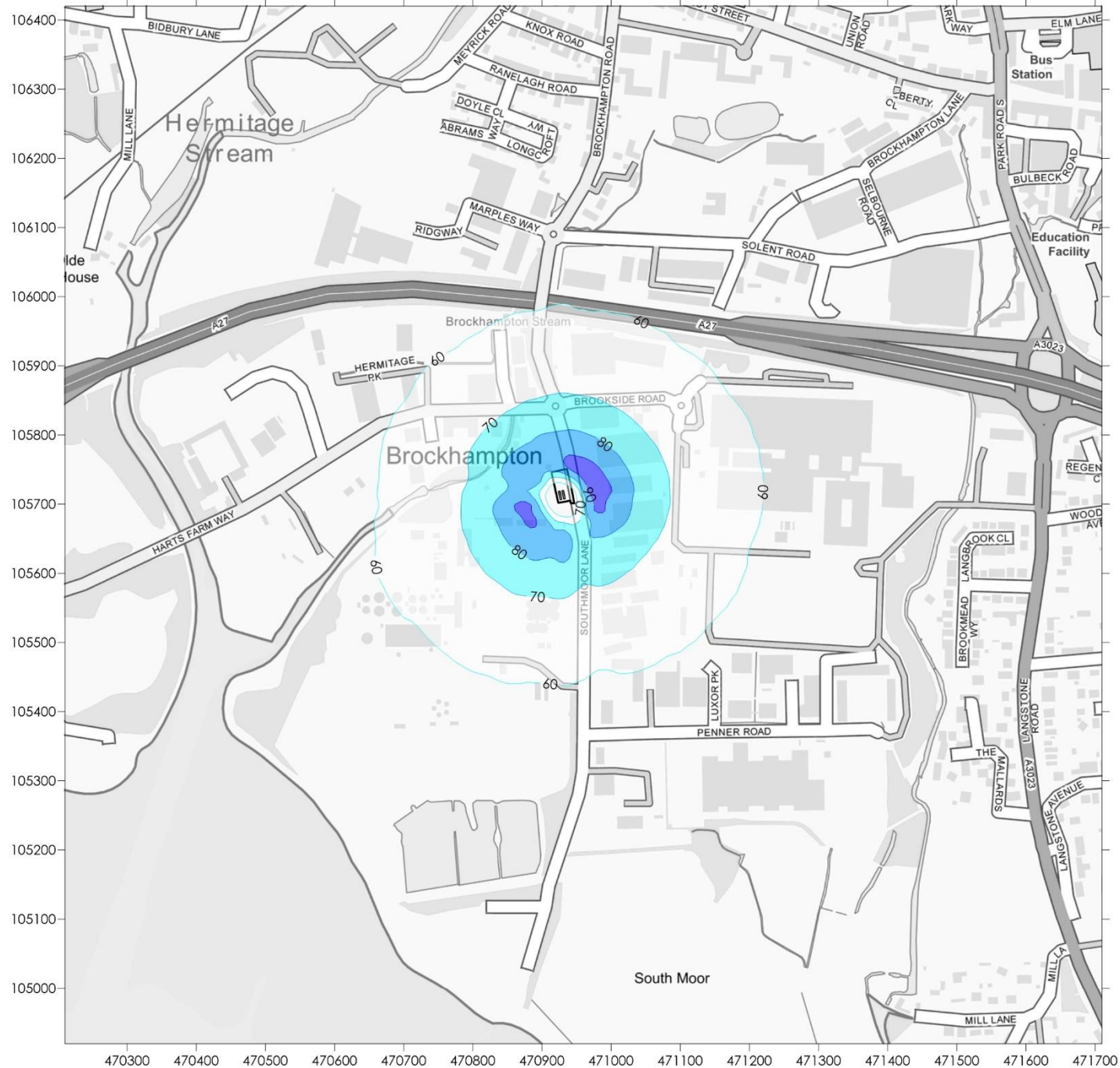
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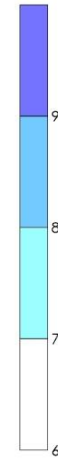
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Site Boundary



Predicted 99.63th %ile
1-hour Mean NO₂
Concentration
(µg/m³)

Title

Figure 7 - Predicted 99.63th %ile
1-hour Mean NO₂ Concentrations
(µg/m³)
2018 Meteorological Data

Project

Air Quality Assessment
Langstone Flexible Generation
Facility

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