Air Quality Assessment

Flexible Generation Facility at New Farm

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Submitted to:
New Farm Energy Limited

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Appendices

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Version History

Version	Date	Amendments
1	05/08/16	First issue

Executive Summary

ADAS UK Ltd was commissioned by New Farm Energy Limited to undertake an Air Quality Assessment for a proposed Flexible Generation Facility (FGF) on land at New Farm, Burton Road, Burton-on-Trent, Staffordshire DE13 9NF.

A FGF is a short-term generating plant designed to be switched on and off at short notice to meet electricity supply demands through the National Grid. Operating hours will be flexible in response to demand from the Grid, but is expected to be approximately 200 hours per annum for a maximum of 2 hours per deployment. Times of operation broadly correspond to the times of peak demand in the domestic electricity supply system (further details are provided later in this report). The plant will be diesel powered and will consist of 25 generators, each with a maximum power output of 400 kW.

As with all combustion processes the generators will give rise to emissions of combustion related pollutants, particularly nitrogen dioxide and particulate matter and these emissions have the potential to cause increases in ground level pollutant concentrations. As such, an Air Quality Assessment was required to quantify impacts at both human and ecological receptors in the vicinity of the site.

The assessment has been carried out with the aim of demonstrating the worst-case environmental impact of all generators operating at full output for 200 hours per annum. As such, predicted concentrations and deposition rates are likely to overestimate actual impacts.

Main Findings

The detailed modelling results show that predicted process contributions to atmospheric concentrations of nitrogen dioxide and particulate matter are below the relevant limits permitted by the Air Quality Standards Regulations at all relevant human exposure receptor points included in the assessment. The impact of the scheme on air quality is assessed as Negligible at all receptors with reference to the impact descriptions provided by the Institute of Air Quality Management's *Planning for Air Quality* Guidance.

Predicted process contributions to atmospheric nitrous oxides concentrations and nitrogen deposition rates are below the suggested level of significance at Old River Dove Marston SSSI (the only identified designated ecological site in proximity to the proposed development). For nitrogen deposition, process environmental contributions are above the relevant Environmental Quality Standards at all ecological receptors, however, this is due to the high background nitrogen deposition rates, which exceed the relevant Environmental Quality Standards as a base condition, irrespective of the proposed development.

1 Introduction

1.1 Background

This Air Quality Assessment has been prepared by ADAS UK Ltd under instruction from New Farm Energy Limited to inform a planning application for a proposed Flexible Generation Facility (FGF) to be developed on land at New Farm, Burton Road, Burton-on-Trent, Staffordshire DE13 9NF.

1.2 Proposed Development

A FGF is a short-term generating plant designed to be switched on and off at short notice to meet electricity supply demands through the National Grid. The number of hours that the plant will operate is expected to be up to 200 hours per annum for a maximum of 2 hours per deployment. Operating hours will be flexible in response to demand from the Grid but broadly correspond to the times of peak demand in the domestic electricity supply system (further details are provided later in this report).

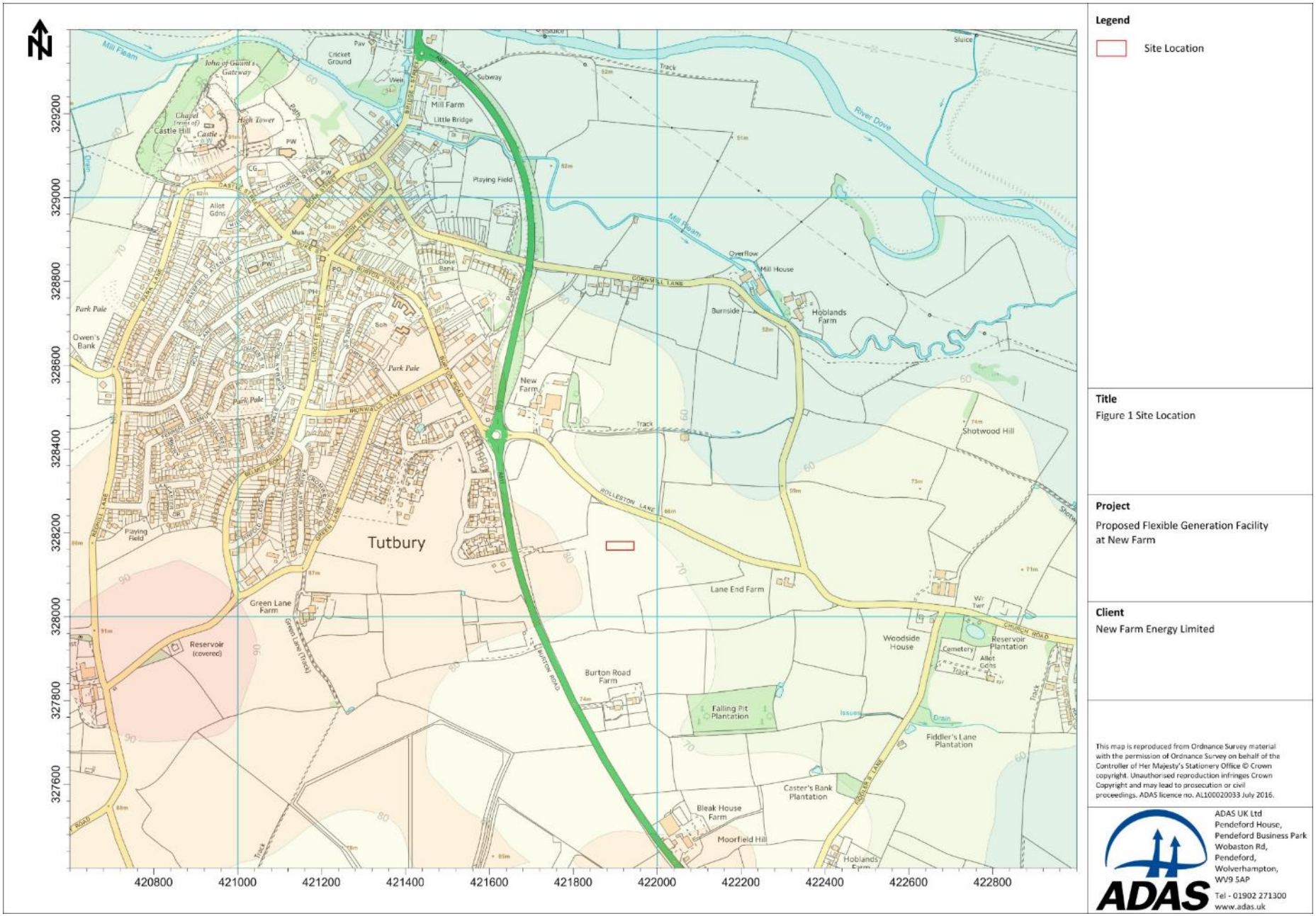
The generators will be diesel powered and will consist of 25 generators, each with a maximum power output of 400 kW.

The generators will be housed within a purpose built compound enclosed by an acoustic fence, boundary security fence and landscape planting. Ancillary development will include a switch room, fuel tank, substation, transformers, an underground electricity cable and an access route to the public highway.

1.3 Site Location and Context

The site is located on the edge of agricultural field to the south-southeast of the farmhouse and farm buildings at New Farm (see Figure 1). The immediate site setting is agricultural.

The southern edge of Tutbury, the new housing development off Burton Road, is located approximately 230m to the west of the application site. A few isolated properties and farms are located to the north, east and south of the application site.



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2 Scope of Assessment

The scope of assessment has been determined with reference to the emissions data for the generators and existing air quality in the local area. This has determined that there are two main pollutants of concern; nitrogen dioxide (NO_2) and particulate matter (PM).

2.1 Nitrogen dioxide

NO_2 is the basis of most Air Quality Management Areas in the UK, with background concentrations frequently elevated in urban areas and close to major transport routes. NO_2 is a product of combustion processes, particularly the burning of fossil fuels, in vehicle engines, power generation and domestic boilers.

UK standards for NO_2 are human health based and distinguish between long-term (expressed as an annual mean) and short-term (expressed as an hourly average not to be exceeded more than a specified number of times per annum). Both reference periods are of relevance to this assessment.

Nitrous oxides (NO_x) are also considered for the purposes of this report as whilst there is no human health based standard for this pollutant, it is relevant for the assessment of ecological receptors.

2.2 Particulates

Particulate matter less than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$ respectively) are the collective terms for airborne particles of both natural and man-made sources. PM_{10} and $PM_{2.5}$ are released by combustion processes and therefore are a key reference point for this assessment.

UK standards for these pollutants are again human-health based with this assessment considering both the long and short-term standards for PM_{10}, and the long-term standard for $PM_{2.5}$ (which does not apply until 2020).

2.3 Receptors Considered

The assessment considers two main types of receptor:

- human health; and,
- ecological.

Human health based receptors are assigned as locations in the area surrounding the site where members of the public may be exposed to emissions from the proposed development. This is mostly at locations of long-term exposure such as residences but other locations such as work places are considered when assessing the short-term standards. Locations that are relevant at the averaging period being considered are selected with reference to the guidance provided in Box 1.1 of the Defra guidance *Local Air Quality Management: Technical Guidance 16 (LAQM TG16)*[1].

Ecoogical receptors primarily refers to sites designated for ecological purposes which may be affected by either airborne concentrations of nitrous oxides (NO_X) or by NO_2.

A full descripiton of receptors considered is provided in following sections.

[1] Local Air Quality Management Technical Guidance (TG16), Defra, 2016.

3 Legislation and Policy

3.1 European Legislation

European Union (EU) air quality legislation is provided within 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 $PM_{2.5}$. The consolidated Directives include:

- Directive 99/30/EC - the First Air Quality "Daughter" Directive - sets ambient Air Quality Limit Values (AQLVs) for NO_2, 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.

3.2 UK Legislation

The Air Quality Standards Regulations (2010) came into force on 11th June 2010 and transpose the EU Directive 2008/50/EC into UK law. AQLVs were published in these regulations for seven pollutants, as well as Target Values for an additional five pollutants.

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 its devolved counter-parts in Scotland, Wales and Northern Ireland) and published in July 2007[2]. 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 exceedances over a specified timescale. These are generally in line with the AQLVs, although the requirements for compliance vary slightly.

Table 1 presents the AQOs for the pollutants considered within this assessment.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	Concentration (µg/m³)	Averaging Period
NO_2	40	Annual Mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM_{10}	40	Annual Mean
	50	24-hour mean; not to be exceeded more than 35 times a year
$PM_{2.5}$	25	Annual Mean (does not apply until 2020)

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

Table 2 summarises the advice provided in Defra guidance LAQM.TG(16) on where the AQOs for pollutants considered within this report apply.

Table 2 Examples of Where the Air Quality Objectives Apply

Averaging Period	Objectives Should Apply At	Objectives 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 and 24-hour mean	All locations where the annual mean and apply. Hotels, gardens of residential properties 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

3.3 Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities 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 locations of relevant exposure (normally residential properties) are likely to be exceeded, the local authority 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.

3.4 Critical Loads and Levels

A critical load is defined by the United Nations Economic Commission for Europe (UNECE)[3] as:

> *"a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"*

A critical level is defined as:

> *"concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge"*

[3] United Nations Economic Commission for Europe, retrieved from http://www.unece.org/env/lrtap/WorkingGroups/wge/definitions.html in July 2016.

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

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	Air Quality Limit Value	
	Concentration (µg/m^3)	Averaging Period
NO_x	30	Annual mean
	75	24-hour mean

Critical loads have been designated within the UK based on the sensitivity of the receiving habitat and have been reviewed for the purpose of this assessment.

4 Baseline

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.

4.1 Local Air Quality Management

As required by the Environmental Act (1995), East Staffordshire Borough Council regularly reviews and assesses air quality within its area of jurisdiction. The Council's Air Quality Strategy[4] states that there are two AQMAs within the borough, both within Burton upon Trent. Both AQMAs have been designated for exceedances of the 40 µg/m^3 annual mean objective for NO_2 from road traffic.

4.2 Air Quality Monitoring

Monitoring of pollutant concentrations is undertaken by East Staffordshire Borough Council and the latest results are detailed in the 2015 Updating and Screening Assessment[5]. East Staffordshire Borough Council operates an automatic monitoring station at Derby Turn, Burton upon Trent which measures NO_2 concentrations. The automatic monitor is located approximately 4.3 km to the southeast of the application site. There is also a Beta Attenuation Monitor at Derby Turn which monitors PM_{10} concentrations.

In addition to this there are also 47 diffusion tubes sites within the East Staffordshire Borough council jurisdiction that monitor NO_2 Concentrations. The nearest diffusion tube sites are located on or near to Horninglow Road, Burton upon Trent, approximately 3.7 km to the southeast.

The monitoring results at these locations are provided below in Table 4.

Table 4 Local Monitoring Results

Monitoring Station ID	Location	2012	2013	2014
NO_2 Pollutant Concentration (µg/m^3)				
CM1 (automatic)	Derby Turn	32.2	29.0	36.0
DT20 (diffusion tube)	Horninglow Road North – appr. Junc. Morleys Hill	25.6	25.3	26.7
DT36 (diffusion tube)	Rolleston Rd – near. Junc. Horninglow Rd	37.5	29.3	28.7
PM_{10} Pollutant Concentration (µg/m^3)				
CM1 (automatic)	Derby Turn	25.4	29.0	31.0

The automatic and diffusion tube monitoring sites in Burton upon Trent are located in close proximity to roads and are primarily intended to monitor the effect of traffic emissions on local pollutant concentrations. This coupled with the considerable distance to the application site means that these stations are not truly representative of local background conditions and therefore the data above has not been used to represent background pollutant concentrations as part of this assessment.

[4] Air Quality Strategy (2015 – 2020). East Staffordshire Borough Council, October 2015, version 1.
[5] 2015 Updating and Screening Assessment for East Staffordshire Borough Council, East Staffordshire Borough Council, May 2015.

4.3 Background Pollutant Concentrations

Predictions of background pollutant concentrations for NO_X, NO_2, PM_{10} and $PM_{2.5}$ were obtained from the national maps available on the Defra LAQM website[6]. These provide mapped concentrations of pollutant concentrations on a 1 x 1 km grid square basis for every local authority in England. The assessment site is located in grid square NGR: 421500,328500. The most recent data for this location was downloaded for the purpose of this assessment and is summarised in Table 5.

Table 5 Predicted Background Pollutant Concentrations

Pollutant	Annual Mean Concentration (µg/m^3) (2015)
NO_X	18.420
NO_2	13.146
PM_{10}	13.899
$PM_{2.5}$	9.033

4.4 Sensitive Receptors

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.

4.4.1 Human Receptors

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

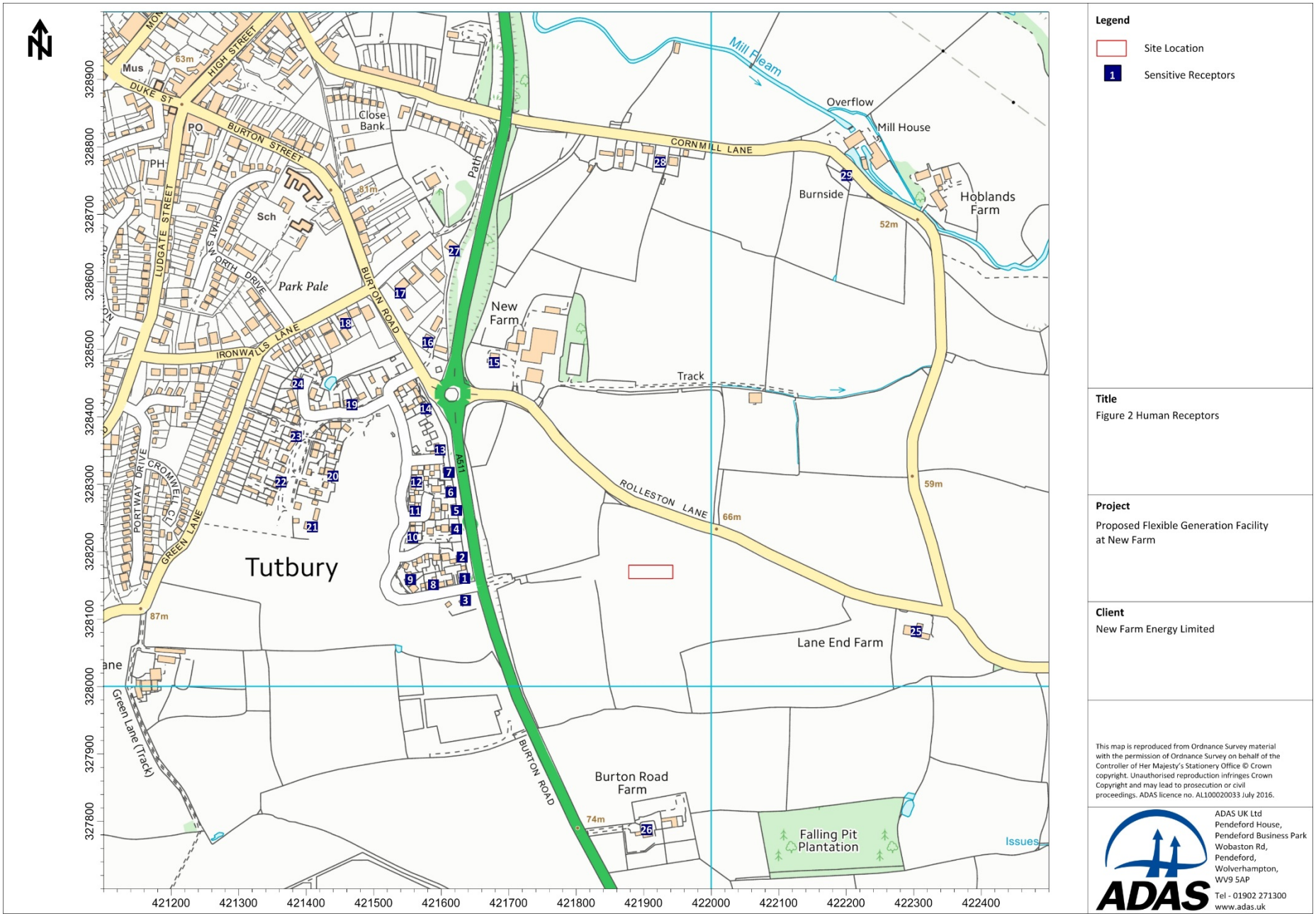
Table 6 Sensitive Human Receptor Locations

Receptor		NGR (m)		Receptor Type and Averaging Periods which Apply
ID	Location	X	Y	
1	Land west of Burton Road housing development	421635	328160	Residential, short and long-term
2	Land west of Burton Road housing development	421631	328192	Residential, short and long-term
3	Land west of Burton Road housing development	421636	328128	Residential, short and long-term
4	Land west of Burton Road housing development	421623	328234	Residential, short and long-term
5	Land west of Burton Road housing development	421623	328261	Residential, short and long-term
6	Land west of Burton Road housing development	421614	328288	Residential, short and long-term
7	Land west of Burton Road housing development	421612	328318	Residential, short and long-term
8	Land west of Burton Road housing development	421588	328151	Residential, short and long-term
9	Land west of Burton Road housing development	421555	328158	Residential, short and long-term

[6] Background Mapping data for local authorities - 2013, Defra, retrieved from https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013 in July 2016.

Receptor		NGR (m)		Receptor Type and Averaging Periods which Apply
ID	Location	X	Y	
10	Land west of Burton Road housing development	421558	328221	Residential, short and long-term
11	Land west of Burton Road housing development	421561	328260	Residential, short and long-term
12	Land west of Burton Road housing development	421563	328303	Residential, short and long-term
13	Land west of Burton Road housing development	421598	328351	Residential, short and long-term
14	Land west of Burton Road housing development	421577	328412	Residential, short and long-term
15	New Farm	421679	328480	Residential, short and long-term
16	Firs Bungalow	421580	328510	Residential, short and long-term
17	Tutlers	421539	328583	Residential, short and long-term
18	Ironwalls Lane	421458	328539	Residential, short and long-term
19	Land west of Burton Road housing development	421468	328418	Residential, short and long-term
20	Land west of Burton Road housing development	421439	328312	Residential, short and long-term
21	Land west of Burton Road housing development	421409	328236	Residential, short and long-term
22	Land west of Burton Road housing development	421363	328303	Residential, short and long-term
23	Land west of Burton Road housing development	421385	328371	Residential, short and long-term
24	Land west of Burton Road housing development	421388	328449	Residential, short and long-term
25	Lane End Farm	422304	328082	Residential, short and long-term
26	Burton Road Farm	421904	327788	Residential, short and long-term
27	The Sycamores	421619	328645	Residential, short and long-term
28	Pennwood House	421925	328778	Residential, short and long-term
29	Burnside	422201	328758	Residential, short and long-term

The sensitive receptors identified in Table 6 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 development that have not been individually identified above. The location of the above receptors are shown in Figure 2.



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4.4.2 Ecological Receptors

Atmospheric emissions from the facility have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. A study was undertaken to identify any designated nature conservation sites within 10 km of the source as required by the Environment Agency's (EA) guidance[7] for:

- Special Areas of Conservation (SACs) and candidate SACs (cSACs) designated under the EC Habitats Directive;
- Special Protection Areas (SPAs) and potential SPAs designated under the EC Birds Directive; and
- Ramsar Sites designated under the Convention on Wetlands of International Importance.

Within 2 km of the source for:

- Sites of Special Scientific Interest (SSSIs) established by the 1981 Wildlife and Countryside Act;

And also within 2 km of the source for:

- National Nature Reserves (NNRs);
- Local Nature Reserves (LNRs);
- Local Wildlife Sites (LWSs), Sites of Interest for Nature Conservation (SINCs) and Sites of Local Interest for Nature Conservation (SLINCs); and
- Ancient woodlands (AWs).

The study was completed using the Multi-Agency Geographic Information for the Countryside (MAGIC) web-based interactive mapping service[8], which draws together information on key environmental schemes and designations for any statutory designations although it should be noted that not all locally designated sites appear on MAGIC.

No SACs, SPAs or Ramsar sites were identified within 10 km. Only one designated site was identified within 2 km, which is Old River Dove Marston SSSI, located approximately 1.7 km to the east-northeast of the application site. This SSSI is a locally important site for aquatic fauna and flora, with open water surrounded by a band of tall mixed fen and swamp communities. A number of discrete receptor points have been identified within the SSSI to provide consideration of impacts throughout the designation. A summary of the locations of these ecological receptor points is provided in Table 7.

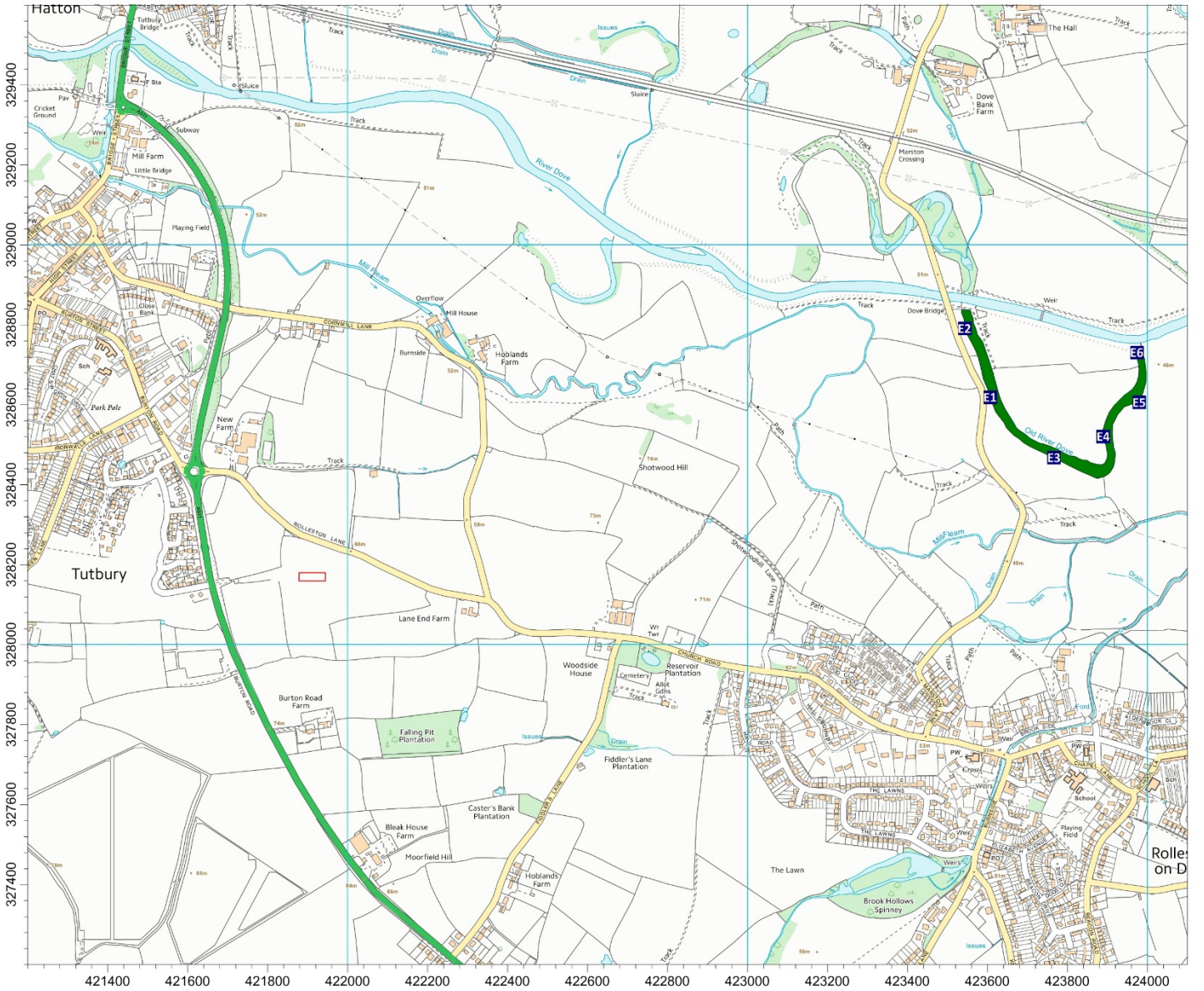
Table 7 Ecological Receptor Locations

Receptor		NGR (m)	
ID	Location	X	Y
E1	Old River Dove Marston SSSI	423607	328619
E2	Old River Dove Marston SSSI	423543	328791
E3	Old River Dove Marston SSSI	423767	328468
E4	Old River Dove Marston SSSI	423890	328521
E5	Old River Dove Marston SSSI	423980	328606
E6	Old River Dove Marston SSSI	423974	328731

The location of the designated site and the receptors points is shown in Figure 3.

[7] Environmental management – guidance: Air emissions risk assessment for your environmental permit, EA, 2016, https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

[8] Multi-Agency Geographic Information for the Countryside, Natural England, retrieved from www.magic.gov.uk in July 2016.



Legend

- Site Location
- Old River Dove Marston SSSI
- E1 Discrete Receptor Points

Title

Figure 3 Ecological Receptors

Project

Proposed Flexible Generation Facility at New Farm

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Critical loads have been designated within the UK based on the sensitivity and qualifying features of the receiving habitat. A review of the Air Pollution Information System (APIS) website[9] was undertaken in order to identify the most suitable habitat description and associated critical load for the area of each designation considered within the model. This was undertaken using the 'search by location' and 'habitat/pollutant impacts' functions within APIS. The habitat types within each designation are listed in accordance with the UK Biodiversity Action Plan (BAP) criteria, which are then split further by the European Nature Information System (EUNIS) habitat type. These were reviewed, along with the habitat maps available through MAGIC, to define the relevant classification at each of the receptor locations. It should be noted that separate habitat types are often listed for European and National designations, although the geographical areas covered are the same. When this was the case the most suitable classification for the area of interest was selected based on the site descriptions given in the citation documents. The relevant critical loads are presented in Table 8.

Table 8 Critical Loads

Site Name	Critical Load	
	Nitrogen Critical Load (kgN/ha/yr)	
	Low	High
Old River Dove Marston SSSI	10	15

Background deposition rates at each ecological receptor location were obtained from the APIS website using the 'search by location' function and are summarised in Table 9.

Table 9 Background Deposition Rates

Site Name	APIS Habitat Critical Load Class	Deposition Rate
		Nitrogen (kgN/ha/yr)
Old River Dove Marston SSSI	Fen, marsh and swamp	24.08

[9] UK Air Pollution Information System, Centre for Ecology and Hydrology (CEH), Retrieved from www.apis.ac.uk in July 2016.

5 Assessment Methodology

Emissions associated with the proposed generators, and the effect of these emissions on the identified receptors have been quantified through dispersion modelling in accordance with the methodology outlined in the following Sections.

An industry standard atmospheric dispersion model, ADMS 5, was used to model releases of the identified substances. The dispersion modelling procedure was as follows:

- Information on site layout and generator positioning was obtained via the Site Layout drawings provided by the applicant.
- Emission rates were obtained from the applicant and equipment suppliers.
- Appropriate data to describe meteorological conditions in the vicinity of the site was obtained from ADM Ltd.
- A receptor grid of potentially sensitive locations was identified in the vicinity of the installation using digital mapping.
- The above information was entered into the dispersion model.
- The dispersion model was run to determine pollutant levels in the vicinity of the site. The results interpretation was based on the 5-year average modelled concentration at any location of relevant exposure.
- The study results were compared with the relevant assessment criteria, predominantly the specified levels for protection of human health provided in Table 1 and the critical level and critical loads for protection of ecological receptors as described in earlier sections.

5.1 Dispersion Modelling

Dispersion modelling was undertaken using ADMS 5.1 (v5.1.2.0), which has been developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS 5 is a steady-state atmospheric dispersion model that is based on modern atmospheric physics. 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.

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.

ADMS 5 has been chosen because it is "fitted for the purpose of the modelling procedure" as defined by the guidelines published by the Royal Meteorological Society[10] [11]. The group that leads the development of ADMS 5 is CERC, but the UK Met Office and others have made significant contributions. The model has been extensively validated against site measurements. Details of these validation studies and information on the development of ADMS are available on the CERC website.

5.1.1 Modelling Scenarios

The model has been based on the assumption that generators will operate for the maximum permitted level of 200 hours per annum at full capacity (i.e., all generators firing simultaneously at full output). This provides a conservative assessment of the site operation.

The hours of operation have been based on the following operating windows shown in Table 10, which were adopted from information provided by the Short-Term Operating Reserve (STOR) section of the

[10] Guidelines issued by the Royal Meteorological Society. Meteorological Applications, 2: 83–88. Britter, R., Collier, C., Griffiths, R., Mason, P., Thomson, D., Timmis, R. and Underwood, B., 1995.

[11] Guidelines for the Preparation of Dispersion Modelling Assessments for Compliance with Regulatory Requirements – an Update to the 1995 Royal Meteorological Society Guidance. Ireland, M., Jones, J., Griffiths, R., Nb, B. and Nelson, N., 2006.

National Grid website. Note that for simplicity and to fit the input data requirements of the model the specified STOR hours have been adapted slightly but where there has been simplification this has been in the form of rounding up of hours rather than down which will ensure a conservative assessment.

Table 10 Adapted National Grid STOR Operating Windows

Weekday		Weekend	
Start	Finish	Start	Finish
07:00	14:00	10:00	14:00
16:00	22:00	16:00	22:00

This equates to a theoretical maximum of approximately 4435 hours per annum when the generating plant could operate were there no restriction on the total number of hours of operation per annum. The model was therefore initially run assuming continuous operation of all generators for this total number of hours. This clearly is well beyond the realistic worst case but it allows initial data to be generated on predicted dispersion, and gives an indication of the maximum process contributions at defined receptor points, which are associated with operation of the generators with the least favourable weather conditions for dispersion.

To then factor the results to the 200 hours, a factor of 0.045 was applied (i.e., equivalent to 200 hrs/4435 hrs) to both the predicted number of exceedances of the short-term objective and the modelled process contribution relative to the long-term averaging periods.

For assessment of the short-term standard for NO_2, the main reference point in the assessment is the number of exceedances against the permitted number of 18. In order to assess against this objective, short-term background has been estimated at twice the long-term average (as advised by EA guidance), this has then been deducted from the short-term objective level of 200 µg/m^3 to set a 'process headroom' threshold in the model. All modelled hourly concentrations above this level over the five year model extent have then been counted to allow direct comparison with the objective levels for NO_2.

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.

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

5.1.2 Process Conditions

Each generator will have its own release point. The locations of the release points and associated emission parameters have been defined based on site layout plans and emission parameters supplied by the applicant and its proposed equipment suppliers. Details of source locations and parameters are summarised in Table 11 below.

The location of the proposed emission release points are shown in Figure 4.

Table 11 Process Conditions

ID	Source	NGR (m)		Height (m)	Diameter (m)	Velocity (m/s)	Temperature (°C)
		X	Y				
P1	Generator exhaust 1	421891	328163	2.45	0.104	55	300
P2	Generator exhaust 2	421899	328163	2.45	0.104	55	300
P3	Generator exhaust 3	421899	328169	2.45	0.104	55	300
P4	Generator exhaust 4	421899	328174	2.45	0.104	55	300
P5	Generator exhaust 5	421899	328177	2.45	0.104	55	300
P6	Generator exhaust 6	421905	328163	2.45	0.104	55	300
P7	Generator exhaust 7	421905	328169	2.45	0.104	55	300
P8	Generator exhaust 8	421905	328174	2.45	0.104	55	300
P9	Generator exhaust 9	421905	328177	2.45	0.104	55	300
P10	Generator exhaust 10	421912	328163	2.45	0.104	55	300
P11	Generator exhaust 11	421912	328169	2.45	0.104	55	300
P12	Generator exhaust 12	421912	328173	2.45	0.104	55	300
P13	Generator exhaust 13	421912	328177	2.45	0.104	55	300
P14	Generator exhaust 14	421928	328163	2.45	0.104	55	300
P15	Generator exhaust 15	421928	328169	2.45	0.104	55	300
P16	Generator exhaust 16	421928	328174	2.45	0.104	55	300
P17	Generator exhaust 17	421928	328177	2.45	0.104	55	300
P18	Generator exhaust 18	421934	328163	2.45	0.104	55	300
P19	Generator exhaust 19	421934	328169	2.45	0.104	55	300
P20	Generator exhaust 20	421934	328174	2.45	0.104	55	300
P21	Generator exhaust 21	421934	328177	2.45	0.104	55	300
P22	Generator exhaust 22	421939	328163	2.45	0.104	55	300
P23	Generator exhaust 23	421939	328169	2.45	0.104	55	300
P24	Generator exhaust 24	421939	328174	2.45	0.104	55	300
P25	Generator exhaust 25	421939	328177	2.45	0.104	55	300

5.2 Model Input Parameters

5.2.1 Mass Emission Rates

Mass emission rates for use in the assessment were derived from information supplied by the applicant and its proposed equipment suppliers and are summarised in Table 12.

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 NO_2. Comparisons of ambient NO and NO_2 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 NO_2.

The assessment requires consideration of ambient NO_2 concentrations at human health receptor points, therefore the mass emission rate provided for NO_x has been factored to account for conversion of NO_x to NO_2 within the atmosphere. For long term (annual mean) NO_2 predictions a mass emission rate has been defined within the model which assumes 100% conversion of NO_x to NO_2. For short term (hourly)

predictions a separate mass emission rate has been defined which assumes 50% conversion of NO_x to NO_2. These conversion factors are set out in the EA's air emissions risk assessment guidance document.

It should be noted that a specific emission rate for $PM_{2.5}$ was not provided for use in the assessment, therefore the same mass emission rate as provided for PM_{10} has been assumed for $PM_{2.5}$. This will lead to double counting of $PM_{2.5}$ emissions within the model, as the $PM_{2.5}$ fraction is already included in the emission rate defined for PM_{10}.

Table 12 Mass Emission Rates

Pollutant	Mass Emission Rate (g/s)
NO_x (Long term)	0.342
NO_x (Short term)	0.171
PM_{10}	0.00404
$PM_{2.5}$	0.00404

5.2.2 Assessment Extents

A Cartesian grid with a resolution of 25 m was included in the model for an area of 600 m by 600 m covering the main facility area, with a 50 m resolution grid extending 400 m from the central grid, followed by a grid with 100 m resolution to a further 600 m and beyond this the resolution is reduced to 200 m and then 400 m. Results at these grid points were subsequently used to produce contour plots using the Surfer software package.

5.2.3 Terrain Data

The land immediately around the application site is fairly level with no gradients greater than 1:10. However as the site is within a valley, the land rises more steeply further to the west of the site. These topographical features may have a significant effect on wind flow and pollutant concentrations within the modelling domain. Therefore terrain data has been included in the modelling. The terrain data file was created using the ADMS terrain converter and is based on Ordnance Survey Land-Form Panorama data.

5.2.4 Building Effects

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.

The main structures associated with the proposed development are the generators themselves, which have been entered as buildings in the model set-up. Due to the number of proposed generators some have been grouped together for purposes of modelling, resulting in a total of three buildings, as indicated in Table 13 and shown in Figure 4.

Table 13 Building Geometries

Building		NGR (m)		Height (m)	Length/ Diameter (m)	Width (m)	Angle (°)
ID	Description	X	Y				
B1	Building 1	421891	328164	2.34	4.5	1.8	90
B2	Building 2	421906	328170	2.34	17.6	15.4	90
B3	Building 3	421933	328170	2.34	14.8	15.4	90


Burnside
Hoblands Farm
52m
New Farm
P5
P9
P13
P4
P8
P12
B2
P3
P7
P11
P2
P6
P10
B1
P1
P17
P21
P25
P16
P20
P24
B3
P15
P19
P23
P14
P18
P22
A511
ROLLESTON LANE
66m
59m
Lane End Farm
328700
328600
328500
328400
328300
328200
328100
421700
421800
421900
422000
422100
422200
422300
422400
Legend
Site Location
Building
Point Source
Title
Figure 4 Location of Modelled Point Sources and Buildings
Project
Proposed Flexible Generation Facility at New Farm
Client
New Farm Energy Limited
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5.2.5 Roughness Length

A roughness length (z_0) of 0.3 m was used in the dispersion modelling study. This value of z_0 is considered appropriate for the morphology of the assessment area and is between the value suggested within ADMS 5 as being suitable for 'agricultural areas (max)'. A roughness length (z_0) of 0.3 m was also considered appropriate for the morphology of the meteorological station.

5.2.6 Monin-Obukhov Length

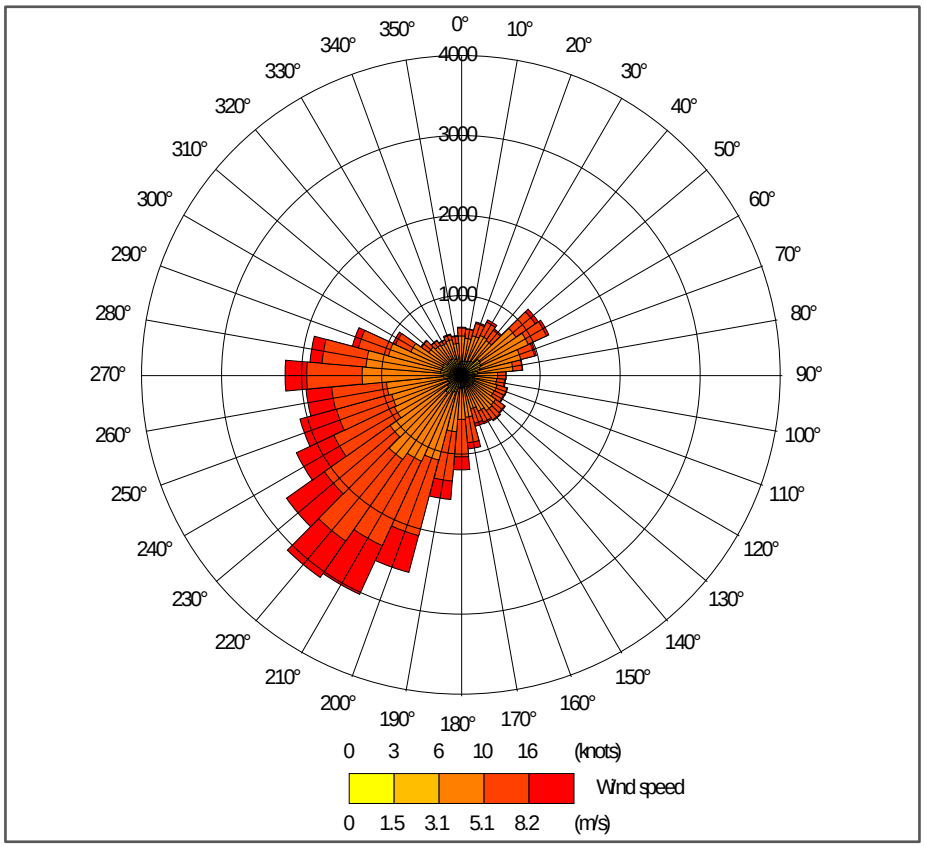
The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 10 m was used in the dispersion modelling study and the meteorological station and is suggested within ADMS 5 as being suitable for 'small towns <50,000'.

5.2.7 Meteorological Data

The closest meteorological station to the proposed development that regularly records all the elements required for dispersion modelling to a suitable standard is at Nottingham East Midlands meteorological station, located approximately 23 km east of the application site. Meteorological data used in this assessment was taken from Nottingham East Midlands meteorological station, over the period 1st January 2011 to 31st December 2015 (inclusive).

All meteorological data used in the assessment was provided by ADM Ltd, a leading supplier of UK and international meteorological data. The wind rose for the weather file, derived from data from the Nottingham East Midlands meteorological station is shown in Figure 5. This illustrates the relative frequency of wind directions and wind speeds used in the modelling study.

Figure 5 Wind Rose Derived from Data from Nottingham East Midlands Meteorological Station (2011 – 2015)



5.3 Baseline Concentrations

A review of existing data in the vicinity of the site was undertaken in Section 4 of this report in order to define baseline pollutant levels. These were subsequently utilised in the assessment to represent existing concentrations in the vicinity of the site.

As noted previously, short-term background concentrations are estimated as twice the annual mean baseline concentration. This approach was adopted throughout the assessment.

5.4 Deposition Rates

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*[12]. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the dry deposition flux.

The conversion factors used are presented within Table 14.

Table 14 Deposition Rates

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to kg/ha/yr of pollutant species)
	Grassland	Forest	
NO_2	0.0015	0.003	96.0

Due to the nature of the modelling area the deposition velocity for 'grassland' was used for the calculation of deposition throughout the assessment within the ADMS 5 model.

5.5 Assessment Criteria

Two main reference points are adopted in the assessment of the modelled outputs:

1. Does the modelled process contribution plus background lead to any predicted exceedance of the AQOs?
2. Are significant impacts predicted in accordance with the impact magnitude and significance criteria provided in Table 6.3 of the Institute of Air Quality Management (IAQM) Guidance *Landuse Planning & Development Control: Planning for Air Quality* (2015)[13]?

5.6 Modelling Uncertainty

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, land use characteristics and meteorology; and,
- variability - randomness of measurements used.

Potential uncertainties in model results have been 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.

[12] Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2006.
[13] Land-use Planning & Development Control: Planning for Air Quality. Institute of Air Quality Management, London, Moorcroft and Barrowcliffe. et al., 2015.

- Meteorological data - Modelling was undertaken using 5-years of annual meteorological data sets from a representative observation site to take account of local conditions and to allow 'smoothing' of atypical short-term weather conditions which may otherwise influence the modelling results.
- Plant operating conditions - Plant operating conditions were provided by the operator and equipment supplier. Operating hours for the plant are regulated under the National Grid STOR system, and have been set accordingly. As such, these are considered to be representative of operating conditions.
- Emission rates - Emission rates were derived from the technical specification of the proposed equipment and therefore represent the maximum potential emissions.
- Background concentrations - Obtained from the Defra mapping study and national monitoring networks. Although these may underestimate actual concentrations in the vicinity of pollutant sources, such as roads, they are considered suitable for an assessment of this nature.
- Receptor locations - A Cartesian Grid was included in the model in order to calculate maximum predicted concentrations throughout the assessment extents. Receptor points were also included at sensitive locations to provide additional consideration of these areas.
- Variability - All model inputs are as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

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.

6 Results

Dispersion modelling was undertaken with the inputs described in Section 5. Reference should be made to Figures AI.1 to AI.3 in Appendix I for graphical representations of predicted pollutant concentrations, inclusive of background, throughout the assessment extents.

6.1 Sensitive Receptors

Predicted concentrations of each pollutant at the sensitive receptor locations identified in Table 6 are summarised in the following Sections.

6.1.1 Nitrogen Dioxide

Annual Mean

Predicted 5-year average annual mean NO_2 concentrations are summarised in Table 15. The data presented provide:

- predicted process contributions to ground level pollutant concentrations (PC) for each receptor included in the assessment where the long-term average applies;
- predicted process environmental contributions (PEC), which include addition of relevant background pollutant concentrations; and,
- proportion of the relevant Environmental Quality Standard (EQS), in this case the long-term objective level for NO_2, that modelled PCs and PECs represent.

Figure AI.1 in Appendix I provides a graphical representation of predicted concentrations throughout the assessment area.

Table AII.1 in Appendix II presents the annual mean NO_2 concentrations for each individual year within the 5-year modelling period.

The modelling results show that the maximum predicted 5-year average annual mean NO_2 process contribution is at Receptor 25, which corresponds to the property at Lane End Farm. At this receptor, the model predicts a 5-year average annual mean process contribution of 0.561 µg/m^3.

This process contribution represents 1.4% of the AQO for NO_2 and is therefore marginally above the 1% insignificance threshold suggested by the EA guidance, however, when added to the background concentration, the resultant process environmental contribution is well below the 40 µg/m^3 limit value permitted by the Air Quality Standards Regulations.

As the predicted increase is less than 2% of the AQO level for NO_2, and as the background levels at this location are less than 75% of the AQO, reference to the impact descriptors in Table 6.3 of the IAQM's *Planning for Air Quality* guidance equates the predicted impact at this location to a 'Negligible' impact. The same conclusion applies at other receptors considered in the assessment.

Table 15 Predicted 5-year Average Annual Mean NO_2 Concentrations

Receptor	Predicted 5-year Average Annual Mean NO_2 Concentration (µg/m^3)		Proportion of the EQS (%)	
ID	PC	PEC	PC	PEC
1	0.497	13.643	1.244	34.108
2	0.430	13.576	1.075	33.939
3	0.555	13.701	1.387	34.251
4	0.360	13.505	0.899	33.764
5	0.337	13.483	0.842	33.707
6	0.307	13.452	0.766	33.631

Receptor	Predicted 5-year Average Annual Mean NO_2 Concentration (µg/m³)		Proportion of the EQS (%)	
ID	PC	PEC	PC	PEC
7	0.287	13.432	0.717	33.581
8	0.397	13.543	0.992	33.857
9	0.329	13.475	0.822	33.687
10	0.277	13.423	0.693	33.557
11	0.257	13.403	0.644	33.508
12	0.241	13.387	0.603	33.467
13	0.256	13.402	0.639	33.504
14	0.214	13.360	0.535	33.400
15	0.260	13.406	0.650	33.515
16	0.186	13.332	0.465	33.330
17	0.149	13.295	0.372	33.236
18	0.128	13.274	0.321	33.185
19	0.150	13.296	0.374	33.239
20	0.155	13.301	0.388	33.253
21	0.158	13.304	0.395	33.260
22	0.126	13.271	0.314	33.179
23	0.125	13.270	0.312	33.176
24	0.116	13.262	0.291	33.156
25	0.561	13.707	1.403	34.267
26	0.221	13.366	0.552	33.416
27	0.154	13.300	0.384	33.249
28	0.198	13.343	0.494	33.359
29	0.274	13.420	0.684	33.549

1-hour Mean

The short-term AQO for NO_2 permits 18 exceedances per annum. The modelled number of exceedances at receptors considered in the assessment, taking account of both process contribution and background ranges between 0 and 4. The highest number of exceedances is predicted at Receptor 3, which represents the residential area to the west of Burton Road.

This provides considerable headroom in the event of periodic pollution events unrelated to the FGF project or in the event that background levels of n NO_2 pollution increase at this location in the future. It is therefore concluded that the proposed development will not entail an increased risk of breaching the short-term objective and the impact is therefore assessed as Neutral.

6.1.2 PM_{10}

Annual Mean

Predicted 5-year average annual mean PM_{10} concentrations are summarised in Table 16. The data presented provide:

- predicted process contributions to ground level pollutant concentrations (PC) for each receptor included in the assessment where the long-term average applies;
- predicted process environmental contributions (PEC), which include addition of relevant background pollutant concentrations; and,
- proportion of the relevant Environmental Quality Standard (EQS), in this case the long-term objective level for PM_{10}, that modelled PCs and PECs represent.

Figure AI.2 in Appendix I provides a graphical representations of predicted concentrations throughout the assessment area.

Table AII.2 in Appendix II presents the annual mean PM_{10} concentrations for each individual year within the 5-year modelling period.

The modelling results show that the maximum predicted 5-year average annual mean PM_{10} process contribution is again at Receptor 25. At this receptor, the modelling predicts a 5-year average annual mean process contribution of 0.007 µg/m^3.

This process contribution is less than the 1% insignificance threshold suggested by the EA guidance and when added to the background concentration, the resultant process environmental contribution is well below the 40 µg/m^3 limit value permitted by the Air Quality Standards Regulations.

Reference to the impact descriptors in Table 6.3 of the IAQM's *Planning for Air Quality* guidance equates the predicted impact at Receptor 3 to a 'Negligible' impact. The same conclusion can be drawn for all other receptors considered in the assessment.

Table 16 Predicted 5-year Average Annual Mean PM_{10} Concentrations

Receptor	Predicted 5-year Average Annual Mean NO_2 Concentration (µg/m^3)		Proportion of the EQS (%)	
ID	PC	PEC	PC	PEC
1	0.006	13.905	0.015	34.763
2	0.005	13.905	0.013	34.761
3	0.007	13.906	0.016	34.765
4	0.004	13.904	0.011	34.759
5	0.004	13.903	0.010	34.759
6	0.004	13.903	0.009	34.758
7	0.003	13.903	0.008	34.757
8	0.005	13.904	0.012	34.760
9	0.004	13.903	0.010	34.758
10	0.003	13.903	0.008	34.757
11	0.003	13.902	0.008	34.756
12	0.003	13.902	0.007	34.756
13	0.003	13.902	0.008	34.756
14	0.003	13.902	0.006	34.755
15	0.003	13.903	0.008	34.756
16	0.002	13.902	0.005	34.754
17	0.002	13.901	0.004	34.753
18	0.002	13.901	0.004	34.752
19	0.002	13.901	0.004	34.753
20	0.002	13.901	0.005	34.753
21	0.002	13.901	0.005	34.753
22	0.001	13.901	0.004	34.752
23	0.001	13.901	0.004	34.752
24	0.001	13.901	0.003	34.752
25	0.007	13.906	0.017	34.765
26	0.003	13.902	0.007	34.755
27	0.002	13.901	0.005	34.753
28	0.002	13.902	0.006	34.754
29	0.003	13.903	0.008	34.757

24-hour Mean

The 24-hour mean AQO for PM_{10} permits 35 exceedances per annum. The modelled number of exceedances at all receptors taking account of both process contribution and background is 0. It is therefore concluded that the proposed development will not entail an increased risk of breaching the 24-hour objective and the impact is therefore assessed as Neutral.

6.1.3 $PM_{2.5}$

Annual Mean

Predicted 5-year average annual mean $PM_{2.5}$ concentrations are summarised in Table 17. The data presented provide:

- predicted process contributions to ground level pollutant concentrations (PC) for each receptor included in the assessment where the long-term average applies;
- predicted process environmental contributions (PEC), which include addition of relevant background pollutant concentrations; and,
- proportion of the relevant Environmental Quality Standard (EQS), in this case the long-term objective level for $PM_{2.5}$, that modelled PCs and PECs represent.

Figure AI.3 in Appendix I provides a graphical representations of predicted concentrations throughout the assessment area.

Table AII.3 in Appendix II presents the annual mean $PM_{2.5}$ concentrations for each individual year within the 5-year modelling period.

The modelling results show that the maximum predicted 5-year average annual mean $PM_{2.5}$ process contribution is again at Receptor 25. At this receptor, the modelling predicts a 5-year average annual mean process contribution of 0.051 µg/m^3.

This process contribution is below the 1% insignificance threshold suggested by the EA guidance and when added to the background concentration, the resultant process environmental contribution is well below the 40 µg/m^3 limit value permitted by the Air Quality Standards Regulations.

Reference to the impact descriptors in Table 6.3 of the IAQM's *Planning for Air Quality* guidance equates the predicted impact at this location to a 'Negligible' impact, with the same conclusion also applying to all other receptor locations considered.

Table 17 Predicted 5-year Average Annual Mean $PM_{2.5}$ Concentrations

Receptor	Predicted 5-year Average Annual Mean NO_2 Concentration (µg/m^3)		Proportion of the EQS (%)	
ID	PC	PEC	PC	PEC
1	0.006	9.039	0.024	36.156
2	0.005	9.038	0.020	36.153
3	0.007	9.040	0.026	36.159
4	0.004	9.037	0.017	36.150
5	0.004	9.037	0.016	36.148
6	0.004	9.037	0.014	36.147
7	0.003	9.037	0.014	36.146
8	0.005	9.038	0.019	36.151
9	0.004	9.037	0.016	36.148
10	0.003	9.036	0.013	36.146
11	0.003	9.036	0.012	36.145
12	0.003	9.036	0.011	36.144

Receptor	Predicted 5-year Average Annual Mean NO_2 Concentration (µg/m³)		Proportion of the EQS (%)	
ID	PC	PEC	PC	PEC
13	0.003	9.036	0.012	36.145
14	0.003	9.036	0.010	36.143
15	0.003	9.036	0.012	36.145
16	0.002	9.035	0.009	36.141
17	0.002	9.035	0.007	36.140
18	0.002	9.035	0.006	36.139
19	0.002	9.035	0.007	36.140
20	0.002	9.035	0.007	36.140
21	0.002	9.035	0.007	36.140
22	0.001	9.035	0.006	36.139
23	0.001	9.035	0.006	36.138
24	0.001	9.035	0.005	36.138
25	0.007	9.040	0.027	36.159
26	0.003	9.036	0.010	36.143
27	0.002	9.035	0.007	36.140
28	0.002	9.035	0.009	36.142
29	0.003	9.036	0.013	36.146

Note: the results presented in the table are the same as for PM_{10} as the emissions data supplied was only for total particulates and therefore both fractions were modelled assuming all particulates are emitted as both PM_{10} and $PM_{2.5}$. This will lead to double counting of these emissions in the model.

6.2 Ecological Receptors

6.2.1 Nitrogen Oxides

Annual Mean

Predicted 5-year average annual mean NO_x concentrations at the ecological receptors are summarised in Table 18.

The modelling results show that predicted process contributions to 5-year average annual mean NO_x concentrations are below the 1% insignificance threshold suggested by EA guidance at all receptors. The process environmental contributions also are well below the relevant EQS in all cases.

Table 18 Predicted 5-year Average Annual Mean NO_x Concentrations

Receptor		Concentration (µg/m³)		Proportion of the EQS (%)	
ID	Location	PC	PEC	PC	PEC
1	Old River Dove Marston SSSI	0.035	18.455	0.115	61.515
2	Old River Dove Marston SSSI	0.024	18.444	0.081	61.481
3	Old River Dove Marston SSSI	0.036	18.456	0.119	61.519
4	Old River Dove Marston SSSI	0.030	18.450	0.100	61.500
5	Old River Dove Marston SSSI	0.027	18.447	0.089	61.489
6	Old River Dove Marston SSSI	0.024	18.444	0.081	61.481

24-hour Mean

Predicted 5-year average 24-hour mean NO_x concentrations at the ecological receptors are summarised in Table 19.

The modelling results show that predicted process contributions to 5-year average 24-hour mean NO_x concentrations are below the 10% short-term insignificance threshold suggested by EA guidance at all ecological receptors included in the modelling. Addition of modelled process contributions to the short-term background concentration, results in process environmental contributions which are well below the relevant EQS in all cases.

Table 19 Predicted 5-year Average 24-hour Mean NO_x Concentrations

Receptor		Concentration (µg/m³)		Proportion of the EQS (%)	
ID	Location	PC	PEC	PC	PEC
1	Old River Dove Marston SSSI	0.035	36.875	0.046	49.166
2	Old River Dove Marston SSSI	0.024	36.864	0.033	49.153
3	Old River Dove Marston SSSI	0.036	36.876	0.048	49.168
4	Old River Dove Marston SSSI	0.030	36.870	0.040	49.160
5	Old River Dove Marston SSSI	0.027	36.867	0.036	49.156
6	Old River Dove Marston SSSI	0.024	36.864	0.033	49.153

6.2.2 Nitrogen Deposition

Predicted 5-year average annual mean nitrogen deposition rates are summarised in Table 20.

The modelling results show that process contributions to nutrient nitrogen deposition rates are less than 1% of the low EQS at all modelled locations within Old River Dove Marston SSSI, and in line with the EA guidance are considered to be insignificant.

Addition of modelled process contributions to location specific background nitrogen deposition rates, results in process environmental contributions which are above both the high and low EQSs at all receptors. This is due to the high background deposition rates, which exceed the EQSs as a base condition, irrespective of the proposed development.

Table 20 Predicted 5-year Average Annual Mean Nitrogen Deposition Rates

Receptor	Concentration (kg N/ha/yr)		Proportion of the EQS (%)			
			Low EQS		High EQS	
ID	PC	PEC	PC	PEC	PC	PEC
1	0.005	24.085	0.05	240.85	0.03	160.57
2	0.004	24.084	0.04	240.84	0.02	160.56
3	0.005	24.085	0.05	240.85	0.04	160.57
4	0.004	24.084	0.04	240.84	0.03	160.56
5	0.004	24.084	0.04	240.84	0.03	160.56
6	0.004	24.084	0.04	240.84	0.02	160.56

6.2.3 Acid Deposition

According to the APIS website the site interest feature is not sensitive to acidification and therefore acid deposition was not assessed any further.

7 Conclusions

The detailed modelling results show that predicted process contributions to atmospheric concentrations of NO_2 and PM are below the relevant limits permitted by the Air Quality Standards Regulations at all relevant human exposure receptor points included in the assessment. The impact of the scheme on air quality is assessed as Negligible at all receptors with reference to the impact descriptions provided by the IAQM's *Planning for Air Quality* Guidance.

Predicted process contributions to atmospheric nitrous oxides concentrations and nitrogen deposition rates are below the suggested level of significance at Old River Dove Marston SSSI (the only identified designated ecological site in proximity to the proposed development). For nitrogen deposition, process environmental contributions are above the relevant EQSs at all ecological receptors, however, this is due to the high background nitrogen deposition rates, which exceed the relevant EQSs as a base condition, irrespective of the proposed development.

In summary it is concluded that the proposed development is not anticipated to result in a significant adverse effect on air quality at the receptors considered in the assessment.

References

1 Local Air Quality Management Technical Guidance (TG16), Defra, 2016.

2 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Defra, 2007.

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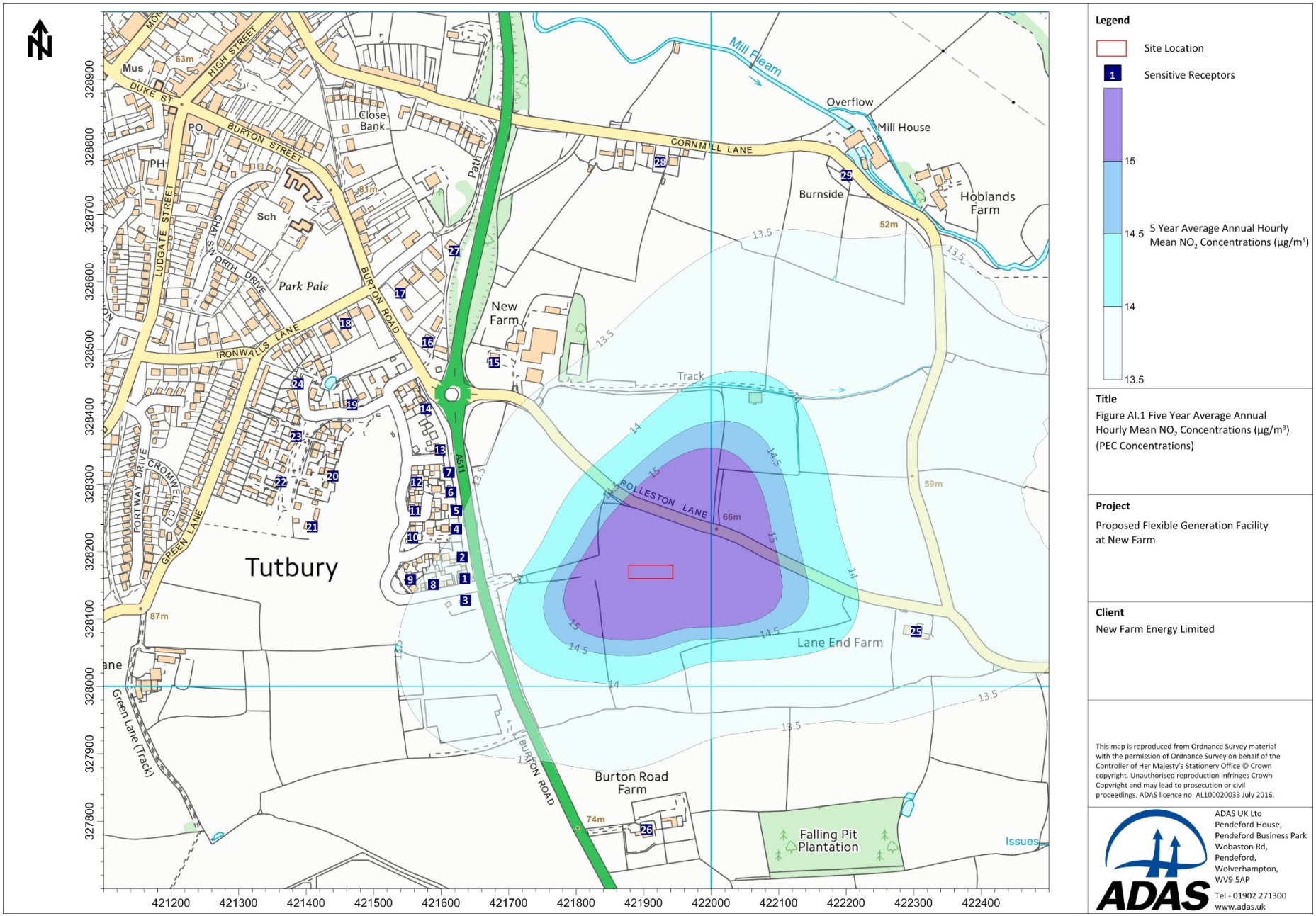
Abbreviations

ADM	Atmospheric Dispersion Modelling
APIS	Air Pollution Information System
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
AW	Ancient Woodland
BAP	Biodiversity Action Plan
CERC	Cambridge Environmental Research Consultants
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EAL	Environmental Assessment Level
EC	European Commission
EQS	Environmental Quality Standard
EU	European Union
EUNIS	European Nature Information System
FGF	Flexible Generation Facility
IAQM	Institute of Air Quality Management
kW	Kilowatt
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
NNR	National Nature Reserve
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
PC	Process contribution
PEC	Predicted environmental concentration
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 µm
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 µm
SAC	Special Area of Conservation
SINC	Site of Interest for Nature Conservation
SLINC	Site of Local Interest for Nature Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STOR	Short-Term Operating Reserve
UNECE	United Nations Economic Commission for Europe
z_0	Roughness length

Appendix 1 Contour Plots

See following page.


Legend
Site Location
Sensitive Receptors
15
14.5
14
13.5
5 Year Average Annual Hourly Mean NO2 Concentrations (µg/m³)
Title
Figure AI.1 Five Year Average Annual Hourly Mean NO2 Concentrations (µg/m³) (PEC Concentrations)
Project
Proposed Flexible Generation Facility at New Farm
Client
New Farm Energy Limited
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BURTON STREET
DUKE ST
LUDGATE STREET
CROMWELL CLOSE
PORTWAY DRIVE
GREEN LANE
Green Lane (Track)
Track
Park Pale
Close Bank
Path
A511
Sch
PO
PH
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81m
87m
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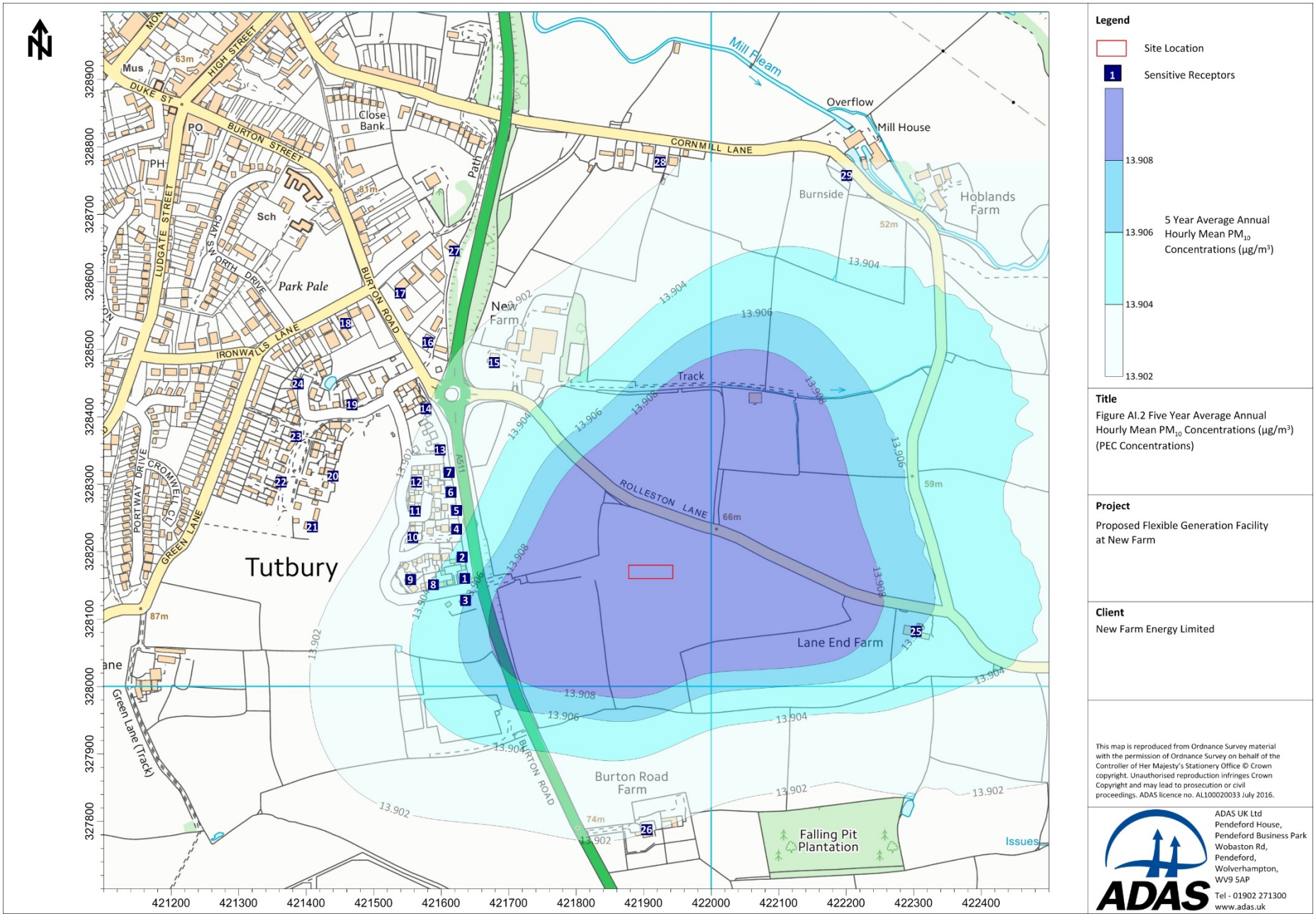

Legend

Site Location

Sensitive Receptors

5 Year Average Annual Hourly Mean PM_{10} Concentrations (µg/m³)

13.908

13.906

13.904

13.902

Title

Figure AI.2 Five Year Average Annual Hourly Mean PM_{10} Concentrations (µg/m³) (PEC Concentrations)

Project

Proposed Flexible Generation Facility at New Farm

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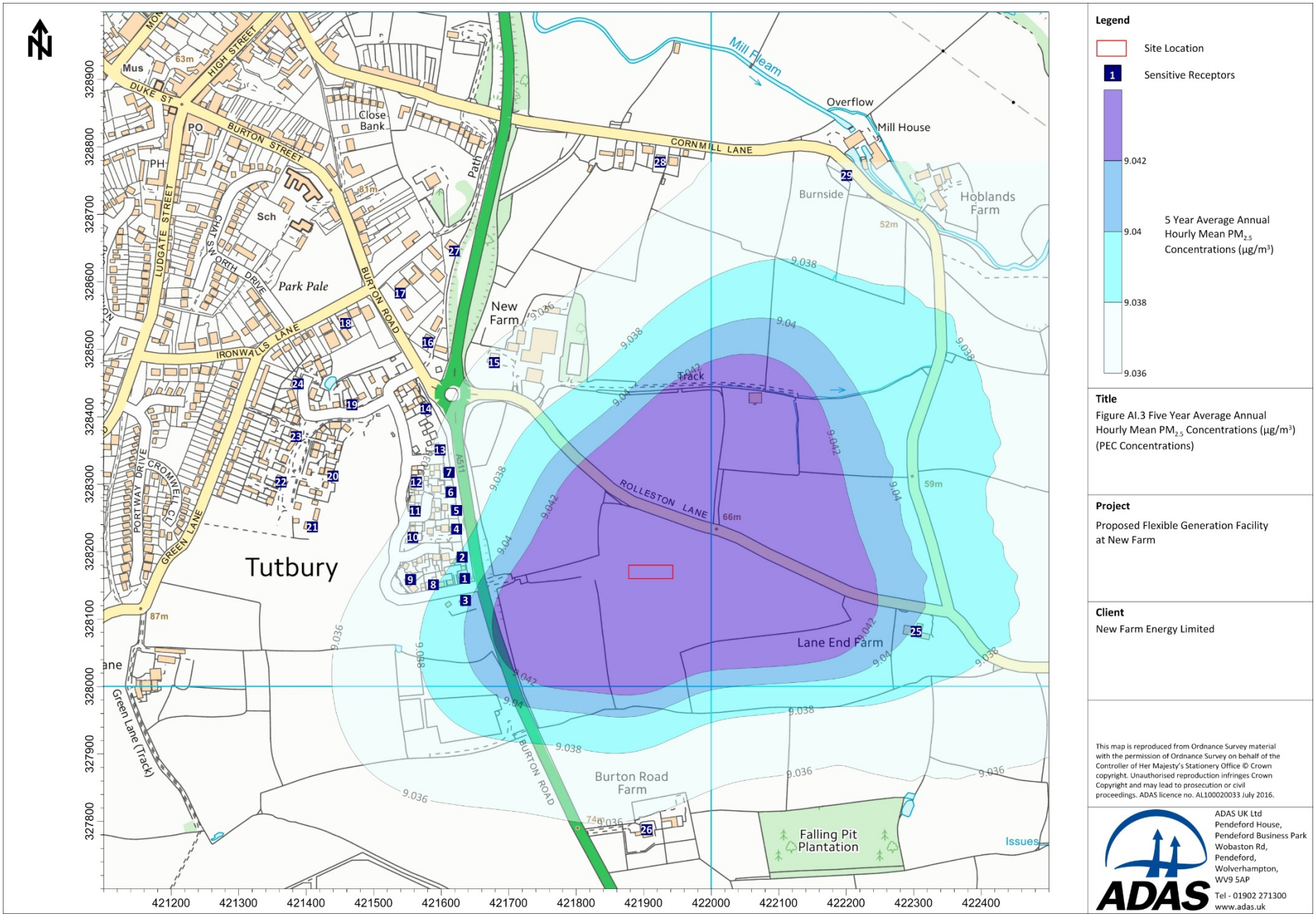

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Appendix II Predicted Annual Mean Concentrations for Individual Years

Table AII.1 Predicted 5-year Annual Mean NO_2 Concentrations

Receptor ID	Predicted Annual Mean NO_2 Concentration (µg/m³)									
	2011		2012		2013		2014		2015	
	PC	PEC	PC	PEC	PC	PEC	PC	PEC	PC	PEC
1	0.399	13.545	0.471	13.616	0.653	13.799	0.549	13.695	0.416	13.561
2	0.377	13.523	0.411	13.557	0.541	13.687	0.442	13.588	0.377	13.523
3	0.411	13.557	0.508	13.654	0.730	13.876	0.668	13.813	0.457	13.603
4	0.356	13.502	0.344	13.490	0.404	13.549	0.360	13.506	0.334	13.480
5	0.361	13.506	0.322	13.468	0.345	13.491	0.342	13.488	0.314	13.460
6	0.343	13.489	0.293	13.439	0.295	13.440	0.318	13.463	0.285	13.431
7	0.325	13.470	0.276	13.422	0.263	13.409	0.301	13.447	0.268	13.414
8	0.312	13.458	0.376	13.522	0.520	13.666	0.446	13.592	0.329	13.475
9	0.264	13.410	0.314	13.460	0.430	13.575	0.362	13.508	0.275	13.420
10	0.257	13.403	0.266	13.411	0.332	13.477	0.277	13.423	0.254	13.400
11	0.265	13.411	0.246	13.392	0.276	13.422	0.257	13.403	0.243	13.389
12	0.271	13.416	0.229	13.375	0.232	13.377	0.248	13.394	0.225	13.371
13	0.285	13.431	0.250	13.396	0.231	13.376	0.269	13.415	0.244	13.390
14	0.228	13.373	0.220	13.365	0.191	13.337	0.221	13.366	0.212	13.357
15	0.286	13.432	0.273	13.419	0.255	13.401	0.248	13.394	0.238	13.384
16	0.195	13.341	0.202	13.348	0.174	13.319	0.180	13.326	0.180	13.325
17	0.157	13.303	0.164	13.309	0.142	13.288	0.140	13.286	0.141	13.286
18	0.133	13.279	0.137	13.283	0.114	13.260	0.128	13.274	0.129	13.275
19	0.170	13.316	0.146	13.291	0.132	13.278	0.156	13.302	0.144	13.290
20	0.168	13.314	0.147	13.293	0.158	13.304	0.155	13.300	0.148	13.294
21	0.145	13.291	0.152	13.298	0.191	13.337	0.156	13.302	0.146	13.292
22	0.129	13.275	0.120	13.266	0.136	13.281	0.123	13.268	0.121	13.267
23	0.143	13.289	0.118	13.264	0.117	13.263	0.127	13.273	0.118	13.263
24	0.134	13.280	0.112	13.258	0.102	13.248	0.122	13.267	0.112	13.257
25	0.467	13.613	0.650	13.796	0.569	13.715	0.505	13.651	0.615	13.760
26	0.168	13.314	0.224	13.370	0.231	13.377	0.269	13.415	0.211	13.357
27	0.175	13.321	0.162	13.308	0.159	13.305	0.138	13.284	0.134	13.280
28	0.252	13.398	0.192	13.338	0.138	13.283	0.208	13.354	0.198	13.344
29	0.294	13.439	0.280	13.426	0.234	13.379	0.274	13.419	0.288	13.434

Table AII.2 Predicted 5-year Annual Mean PM_{10} Concentrations

Receptor ID	Predicted Annual Mean PM_{10} Concentrations (µg/m³)									
	2011		2012		2013		2014		2015	
	PC	PEC	PC	PEC	PC	PEC	PC	PEC	PC	PEC
1	0.005	13.904	0.006	13.905	0.008	13.907	0.006	13.906	0.005	13.904
2	0.004	13.904	0.005	13.904	0.006	13.906	0.005	13.905	0.004	13.904
3	0.005	13.904	0.006	13.905	0.009	13.908	0.008	13.907	0.005	13.905
4	0.004	13.904	0.004	13.904	0.005	13.904	0.004	13.904	0.004	13.903
5	0.004	13.904	0.004	13.903	0.004	13.904	0.004	13.903	0.004	13.903
6	0.004	13.903	0.003	13.903	0.003	13.903	0.004	13.903	0.003	13.903
7	0.004	13.903	0.003	13.903	0.003	13.903	0.004	13.903	0.003	13.903
8	0.004	13.903	0.004	13.904	0.006	13.906	0.005	13.905	0.004	13.903
9	0.003	13.903	0.004	13.903	0.005	13.905	0.004	13.904	0.003	13.903
10	0.003	13.902	0.003	13.903	0.004	13.903	0.003	13.903	0.003	13.902
11	0.003	13.903	0.003	13.902	0.003	13.903	0.003	13.902	0.003	13.902
12	0.003	13.903	0.003	13.902	0.003	13.902	0.003	13.902	0.003	13.902
13	0.003	13.903	0.003	13.902	0.003	13.902	0.003	13.903	0.003	13.902
14	0.003	13.902	0.003	13.902	0.002	13.902	0.003	13.902	0.003	13.902
15	0.003	13.903	0.003	13.903	0.003	13.902	0.003	13.902	0.003	13.902
16	0.002	13.902	0.002	13.902	0.002	13.901	0.002	13.902	0.002	13.902
17	0.002	13.901	0.002	13.901	0.002	13.901	0.002	13.901	0.002	13.901
18	0.002	13.901	0.002	13.901	0.001	13.901	0.002	13.901	0.002	13.901
19	0.002	13.901	0.002	13.901	0.002	13.901	0.002	13.901	0.002	13.901
20	0.002	13.901	0.002	13.901	0.002	13.901	0.002	13.901	0.002	13.901
21	0.002	13.901	0.002	13.901	0.002	13.902	0.002	13.901	0.002	13.901
22	0.002	13.901	0.001	13.901	0.002	13.901	0.001	13.901	0.001	13.901
23	0.002	13.901	0.001	13.901	0.001	13.901	0.002	13.901	0.001	13.901
24	0.002	13.901	0.001	13.901	0.001	13.901	0.001	13.901	0.001	13.901
25	0.006	13.905	0.008	13.907	0.007	13.906	0.006	13.905	0.007	13.907
26	0.002	13.901	0.003	13.902	0.003	13.902	0.003	13.903	0.002	13.902
27	0.002	13.902	0.002	13.901	0.002	13.901	0.002	13.901	0.002	13.901
28	0.003	13.902	0.002	13.902	0.002	13.901	0.002	13.902	0.002	13.902
29	0.003	13.903	0.003	13.903	0.003	13.902	0.003	13.903	0.003	13.903

Table AII.3 Predicted 5-year Annual Mean $PM_{2.5}$ Concentrations

Receptor ID	Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³)									
	2011		2012		2013		2014		2015	
	PC	PEC	PC	PEC	PC	PEC	PC	PEC	PC	PEC
1	0.005	9.038	0.006	9.039	0.008	9.041	0.006	9.040	0.005	9.038
2	0.004	9.038	0.005	9.038	0.006	9.040	0.005	9.038	0.004	9.038
3	0.005	9.038	0.006	9.039	0.009	9.042	0.008	9.041	0.005	9.039
4	0.004	9.037	0.004	9.037	0.005	9.038	0.004	9.037	0.004	9.037
5	0.004	9.037	0.004	9.037	0.004	9.037	0.004	9.037	0.004	9.037
6	0.004	9.037	0.003	9.037	0.003	9.037	0.004	9.037	0.003	9.037
7	0.004	9.037	0.003	9.036	0.003	9.036	0.004	9.037	0.003	9.036
8	0.004	9.037	0.004	9.038	0.006	9.039	0.005	9.038	0.004	9.037
9	0.003	9.036	0.004	9.037	0.005	9.038	0.004	9.037	0.003	9.036
10	0.003	9.036	0.003	9.036	0.004	9.037	0.003	9.036	0.003	9.036
11	0.003	9.036	0.003	9.036	0.003	9.036	0.003	9.036	0.003	9.036
12	0.003	9.036	0.003	9.036	0.003	9.036	0.003	9.036	0.003	9.036
13	0.003	9.037	0.003	9.036	0.003	9.036	0.003	9.036	0.003	9.036
14	0.003	9.036	0.003	9.036	0.002	9.035	0.003	9.036	0.003	9.036
15	0.003	9.037	0.003	9.036	0.003	9.036	0.003	9.036	0.003	9.036
16	0.002	9.035	0.002	9.036	0.002	9.035	0.002	9.035	0.002	9.035
17	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035
18	0.002	9.035	0.002	9.035	0.001	9.034	0.002	9.035	0.002	9.035
19	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035
20	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035
21	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035
22	0.002	9.035	0.001	9.035	0.002	9.035	0.001	9.035	0.001	9.035
23	0.002	9.035	0.001	9.035	0.001	9.035	0.002	9.035	0.001	9.035
24	0.002	9.035	0.001	9.034	0.001	9.034	0.001	9.035	0.001	9.034
25	0.006	9.039	0.008	9.041	0.007	9.040	0.006	9.039	0.007	9.040
26	0.002	9.035	0.003	9.036	0.003	9.036	0.003	9.036	0.002	9.036
27	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035	0.002	9.035
28	0.003	9.036	0.002	9.035	0.002	9.035	0.002	9.036	0.002	9.035
29	0.003	9.037	0.003	9.036	0.003	9.036	0.003	9.036	0.003	9.037