Air Quality Assessment Addendum

Streetly Hall Farm, West Wickham

Client: Streetly Hall Estate Partnership

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Serendipity Labs, Building 7, Exchange Quay, Salford, M5 3EP

info@red-env.co.uk | 0161 706 0075 | www.red-env.co.uk

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1.0 INTRODUCTION

1.1.1 Redmore Environmental Ltd was commissioned by Streetly Hall Estate Partnership to undertake an Air Quality Assessment (reference: 5949-1r2) in support of the planning application (reference: CCC/23/110/FUL) for a proposed Anaerobic Digestion (AD) plant at Streetly Hall Farm, West Wickham. Following submission, a consultation response was received from Natural England (NE) (reference: 458961) that requested the following further information in relation to air quality:

- Details of lagoons and lagoon cover type; and,
- Revised in-combination assessment for air quality impacts on the Over and Lawn Woods Site of Special Scientific Interest (SSSI).

1.1.2 An Air Quality Assessment Addendum has been produced to address the above comments. This is provided in the following report.

1.1.3 It should be noted that further information was also requested by NE in relation to water quality and water resources. This has been addressed elsewhere in the submission.

2.0 LAGOONS

2.1.1 The proposed development includes the following lagoons:

- Surface water lagoon;
- Dirty water lagoon; and,
- Digestate lagoon.

2.1.2 The surface water lagoon will be utilised for the storage of surface water collected from the site outside of the separate digesters area after precipitation events. As the water will be clean, there will no atmospheric emissions from the lagoon and a cover is not required.

2.1.3 The dirty water lagoon will be utilised for the storage of surface water collected from the containment area after precipitation events, as well as emergency containment should leakage occur. Once collected, the water will be pumped directly back into the digesters to assist in the process. As such, the lagoon will be empty during normal operation and there will no atmospheric emissions. A cover is therefore not required. It is confirmed any material stored in the dirty water lagoon would not be classed as slurry.

2.1.4 The digestate lagoon will be utilised to store PAS110 or pasteurised liquid digestate prior to transfer off-site for use as agricultural fertiliser. The lagoon will be designed to comply with SSAFO, CIRIA C759 and C736. It will be double lined with HDPE with a cuspal drainage layer sandwiched between to provide leak detection. The lagoon will have a floating 1mm LLDPE cover installed. This will rise and fall with the amount of digestate stored in the lagoon to limit emissions as far as possible. Floating covers are standard solutions for digestate lagoons and similar designs are utilised throughout the UK and Europe.

2.1.5 The use of a floating cover on the digestate storage lagoon and the associated specification can be secured through a suitably worded planning condition. Additionally, the facility will require an Environmental Permit from the Environment Agency (EA) prior to operation. This will also require the digestate lagoon to be covered in accordance with best practice. As such, there are multiple future compliance routes to ensure emissions from the digestate lagoon are controlled.

3.0 IMPACT ASSESSMENT

3.1 Introduction

3.1.1 Activities at the proposed AD plant, including combustion processes and material storage, have the potential to affect pollutant concentrations at sensitive ecological locations in the vicinity of the site. These were quantified through dispersion modelling and reported in the original Air Quality Assessment. Subsequent to submission, a planning application for a separate AD plant was submitted to Suffolk County Council (reference: SCC/0045/23SE). This was not included in the original In-Combination Assessment as details were not available at the time of completion. As such, a revised In-Combination Assessment has been undertaken to consider impacts associated with the Suffolk AD Plant. This is summarised in the following Sections.

3.1.2 It should be noted that a number of discrepancies were identified in the ammonia (NH_3) emission rate calculations used in the initial model. These have therefore been amended as necessary and the revised results provided below.

3.2 Model Inputs

Introduction

3.2.1 Dispersion modelling was undertaken using ADMS-6.0 (v6.0.0.1), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. The following original inputs were utilised in the further modelling:

- Building geometries;
- Meteorological data;
- Roughness length;
- Monin-Obukhov length; and,
- Deposition calculation method. It should be noted that the deposition module was engaged for both NH_3 and oxides of nitrogen (NO_x).

3.2.2 The updated parameters are summarised in the following Sections. Reference should be made to the original Air Quality Assessment for details of the above inputs, as well as further information regarding site operations and associated influence on emissions.

Emissions

Combined Heat and Power Unit

3.2.3 A summary of the Combined Heat and Power (CHP) unit inputs is provided in Table 1. These were obtained from the relevant Technical Data Sheet and information provided by Streetly Hall Estate Partnership.

Table 1 CHP Unit Process Conditions

Parameter	Unit	Value
Stack position	National Grid Reference (NGR)	559980.3, 248532.4
Stack height	m	3.6
Stack diameter	m	0.4
Exhaust gas temperature	°C	125
Exhaust gas moisture content	%	11.49
Exhaust gas flow rate	Nm^3/s	1.11
Exhaust gas flow rate	m^3/s	1.83
Exhaust gas efflux velocity	m/s	14.53

3.2.4 The relevant Emission Limit Values (ELVs) for exhaust gas pollutant concentrations for the CHP unit are shown in Table 2. These are the maximum permitted levels and therefore provide a worst case representation of potential emissions.

Table 2 CHP Unit Emission Concentrations

Pollutant	Pollutant Emission Concentration (mg/Nm^3)
NO_x	250
Sulphur dioxide (SO_2)	40

3.2.5 The pollutant mass emission rates for use in the assessment were derived from the concentrations shown in Table 2 and the flow rate shown in Table 1. These are summarised in Table 3.

Table 3 CHP Unit Pollutant Mass Emission Rates

Pollutant	Pollutant Mass Emission Rate (g/s)
NO_x	0.2771
SO_2	0.0443

Power to Heat Module

3.2.6 A summary of the Power to Heat (PTH) module process conditions is provided in Table 4. These were obtained from the Technical Data Sheet for a similar PTH module.

Table 4 PTH Module Process Conditions

Parameter	Unit	Value
Stack position	NGR	559990.9, 248543.6
Stack height	m	3.8
Stack diameter	m	0.2
Exhaust gas temperature	°C	120
Exhaust gas flow rate	Nm^3/s	0.218
Exhaust gas flow rate	m^3/s	0.31
Exhaust gas efflux velocity	m/s	10.00

3.2.7 The relevant ELVs for exhaust gas pollutant concentrations for the PTH module are shown in Table 5.

Table 5 PTH Module Emission Concentrations

Pollutant	Pollutant Emission Concentration (mg/Nm^3)
NO_x	200
SO_2	100

3.2.8 The pollutant mass emission rates for use in the assessment were derived from the concentrations shown in Table 5 and the flow rate shown in Table 4. These are summarised in Table 6.

Table 6 PTH Module Pollutant Mass Emission Rates

Pollutant	Pollutant Mass Emission Rate (g/s)
NO_x	0.0436
SO_2	0.0218

Intake and Processing Building

3.2.9 Emissions from the intake and processing building abatement system were included in the model as a point source. The exact specification has not been finalised at the time of reporting. As such, the process conditions shown in Table 7 were utilised to represent anticipated parameters.

Table 7 Intake and Processing Building Process Conditions

Parameter	Unit	Value
Stack position	NGR	560052.2, 248462.0
Stack height	m	4.0
Stack diameter	m	1.5
Exhaust gas efflux velocity	m/s	15.83

3.2.10 The following NH_3 emission rate was obtained from the EA[1]:

- Manure - deep pit - 2.38kgNH_3/tonne.

3.2.11 The plant is proposed to process 12,000tpa of poultry litter in the intake and processing building. As such, it was assumed that the maximum stocking volume is constantly stored. Additionally, any reduction in emission associated with the abatement system was not considered to ensure a worst case representation of atmospheric emissions. The model input data is summarised in Table 8.

[1] EA, Pollution Inventory Reporting, 2013.

Table 8 Intake and Processing Building Model Input

Parameter	Unit	Value
NH_3 emission rate	g/s	0.000000906

Liquid Digestate Storage Lagoon

3.2.12 The digestate lagoon was included in the model as an area source. The following NH_3 emission rate was obtained from the SCAIL database[2]:

- Lagoon - no cover - 1.4kgNH_3/m^2/yr.

3.2.13 The lagoon will be covered. Information obtained from SCAIL[3] indicated that completely covering lagoons with an engineered cover reduces NH_3 emissions by 90%. This is due to the reduced air exchange with the atmosphere through the provision of an enclosed environment. The relevant factor was therefore applied to the calculated emission rate to account for reduced releases from the lagoon. This was then converted into an area emission rate suitable for input into the model.

3.2.14 The model input data is summarised in Table 9.

Table 9 Liquid Digestate Storage Lagoon Model Input

Parameter	Unit	Value
NH_3 emission rate	g/m^2/s	0.00000444

Exposed Maize

3.2.15 Maize will be exposed at the proposed AD plant in the following sources:

- Clamp 1;
- Clamp 2; and,
- Transfer from clamp 1 and clamp 2 to feed hopper.

2 SCAIL-Agriculture Update Sniffer ER26: Final Report, Sniffer, 2014.

3 SCAIL-Agriculture Update Sniffer ER26: Final Report, Sniffer, 2014.

3.2.16 Maize was included in the model as four area sources representing the clamps and two line sources representing the transfer process.

3.2.17 An NH_3 emission rate was obtained from Natural Resources Wales (NRW)[4] as follows:

- Feedstock - 0.009kgNH_3/kgN in feedstock.

3.2.18 The plant is proposed to process 16,000tpa of maize. The nitrogen content of maize is 0.0046kgN/kg[5]. As such, the feedstock will contain 73,600kgN. Multiplying this by the emission rate above provided an annual NH_3 emission of 662.4kgNH_3/yr. The release was apportioned across the clamp and transfer sources, as well as the feed hopper.

3.2.19 It should be noted that the clamps will be covered, with the face exposed only during loading. Each face has a modelled area of 148.2m^2. The area and duration of emissions was taken into account in the model inputs summarised in Table 10.

Table 10 Exposed Maize Model Inputs

Source		NH_3 Emission Rate (g/m^2/s)
1	Clamp 1 - exposed face	0.0000234
2	Clamp 1 - exposed face	0.0000234
3	Clamp 2 - exposed face	0.0000234
4	Clamp 2 - exposed face	0.0000234
5	Transfer from clamp 1 to feed hopper	0.0000117
6	Transfer from clamp 2 to feed hopper	0.0000117

Exposed Whole Crop Cereal

3.2.20 Whole crop cereal material will be exposed at the proposed AD plant in the following sources:

- Clamp 3; and,

4 Emission factor for anaerobic digestion feedstock and digestate for modelling and reporting, NRW, 2022.

5 Emission factor for anaerobic digestion feedstock and digestate for modelling and reporting, NRW, 2022.

- Transfer from clamp 3 to feed hopper.

3.2.21 Whole crop cereal was included in the model as two area sources representing the clamps and one line source representing the transfer process.

3.2.22 An NH_3 emission rate was obtained from NRW[6] as follows:

- Feedstock - 0.009kgNH_3/kgN in feedstock.

3.2.23 The plant is proposed to process 15,000tpa of whole crop cereal. The nitrogen content of whole crop cereal is 0.0051kgN/kg[7]. As such, the feedstock will contain 76,500kgN. Multiplying this by the emission rate above provided an annual NH_3 emission of 688.5kgNH_3/yr. The release was apportioned across the clamp and transfer sources, as well as the feed hopper.

3.2.24 It should be noted that the clamps will be covered, with the face exposed only during loading. Each face has an exposed area of 126.0m^2. The area and duration of emissions was taken into account in the model inputs summarised in Table 11.

Table 11 Exposed Whole Crop Cereal Model Inputs

Source		NH_3 Emission Rate (g/m^2/s)
1	Clamp 3 - exposed face	0.0000530
2	Clamp 3 - exposed face	0.0000530
3	Transfer from clamp 3 to feed hopper	0.0000265

Exposed Cattle Manure

3.2.25 Cattle manure will be exposed at the proposed AD plant in the following sources:

- Clamp 4; and,
- Transfer from clamp 4 to feed hopper.

6 Emission factor for anaerobic digestion feedstock and digestate for modelling and reporting, NRW, 2022.

7 Emission factor for anaerobic digestion feedstock and digestate for modelling and reporting, NRW, 2022.

3.2.26 Cattle manure was included in the model as one area source representing the clamp and one line source representing the transfer process.

3.2.27 An NH_3 emission rate was obtained from NRW[8] as follows:

- Feedstock - 0.009kgNH_3/kgN in feedstock.

3.2.28 The plant is proposed to process 5,000tpa of cattle manure. The nitrogen content of cattle manure is 0.0052kgN/kg[9]. As such, the feedstock will contain 26,000kgN. Multiplying this by the emission rate above provided an annual NH_3 emission of 234.0kgNH_3/yr. The release was apportioned across the clamp and transfer sources, as well as the feed hopper.

3.2.29 It should be noted that the material will be covered and only exposed during loading. The maximum area of material on site will be 800.0m^2. The area and duration of emissions was taken into account in the model inputs summarised in Table 12.

Table 12 Exposed Cattle Manure

Source		NH_3 Emission Rate (g/m^2/s)
1	Clamp 4 - exposed face	0.0000071
2	Transfer from clamp 4 to feed hopper	0.0000036

Exposed Material in Feed Hopper

3.2.30 There will be a mixture of exposed maize, whole crop cereal and cattle manure in the feed hopper. The annual NH_3 emission rates calculated in the previous Sections were therefore combined and apportioned across the area source utilised to represent the feed hopped in the model.

8 Emission factor for anaerobic digestion feedstock and digestate for modelling and reporting, NRW, 2022.

9 Emission factor for anaerobic digestion feedstock and digestate for modelling and reporting, NRW, 2022.

Terrain Data

3.2.31 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. A new file covering a wider extent than the original model was produced using the method suggested by CERC[10].

Baseline Pollutant Levels

3.2.32 Updated baseline pollutant concentrations and deposition rates at each ecological receptor were obtained from the Air Pollution Information Service (APIS) website[11]. These are summarised in Table 13.

Table 13 Baseline Pollution Levels

Receptor		Annual Mean NO_x Conc. ($\mu g/m^3$)	Annual Mean NH_3 Conc. ($\mu g/m^3$)	Annual Mean SO_2 Conc. ($\mu g/m^3$)	Baseline Deposition Rate	
					Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)
E1	Borley Wood AW	8.73	1.53	0.75	26.40	1.89
E2	Borley Wood AW	8.64	1.54	0.74	26.49	1.89
E3	Borley Wood AW	8.64	1.54	0.74	26.49	1.89
E4	Balsham Wood AW and SSSI	8.65	1.52	0.75	26.59	1.9
E5	Balsham Wood AW and SSSI	8.54	1.51	0.73	26.70	1.91
E6	Balsham Wood AW and SSSI	8.54	1.51	0.73	26.70	1.91
E7	Over and Lawn Woods SSSI	8.34	1.45	0.68	27.04	1.93
E8	Hare Wood AW	8.54	1.47	0.71	26.90	1.92
E9	Hare Wood AW	8.44	1.46	0.69	27.03	1.93
E10	Hare Wood AW	8.44	1.46	0.69	27.03	1.93

[10] Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.

[11] www.apis.ac.uk.

Receptor		Annual Mean NO_x Conc. ($\mu g/m^3$)	Annual Mean NH_3 Conc. ($\mu g/m^3$)	Annual Mean SO_2 Conc. ($\mu g/m^3$)	Baseline Deposition Rate	
					Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)
E11	Furze Hill SSSI	9.15	1.58	0.80	14.82	1.06
E12	Furze Hill SSSI	9.15	1.58	0.80	14.82	1.06
E13	Furze Hill SSSI	9.15	1.58	0.80	14.82	1.06
E14	Roman Road SSSI	8.86	1.56	0.76	14.94	1.07
E15	Fleam Dyke SSSI	8.83	1.52	0.75	15.15	1.08

3.3 Assessment Criteria

3.3.1 EA guidance 'Air emissions risk assessment for your environmental permit'[12] states that Process Contributions (PCs) at SSSIs can be screened as insignificant if they meet the following criteria:

- 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 Predicted Environmental Concentration (PEC) is less than 70% of the long term environmental standard.

3.3.2 It should be noted that the 1% criterion is also recommended in NE guidance[13] as an appropriate threshold for screening out likely significant effects either alone or in-combination with other plans and projects at ecological designations.

3.3.3 EA guidance states that PCs at Ancient Woodland (AW) can be screened as insignificant if they meet the following criteria:

- The long-term PC is less than 100% of the long-term environmental standard for protected conservation areas.

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

13 Air quality risk assessment interim guidance, NE, 2022.

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

3.4 Results

3.4.1 Dispersion modelling was undertaken with the inputs described in Section 3.2. The results are outlined in the following Sections.

Development Alone

Nitrogen Oxides

3.4.2 Predicted annual mean NO_x PECs at the ecological receptor locations as a result of emissions from the development alone are summarised in Table 14.

Table 14 Predicted Annual Mean NO_x Concentrations: Development Alone

Receptor		Predicted Annual Mean NO_x PEC (µg/m³)				
		2016	2017	2018	2019	2020
E1	Borley Wood AW	8.77	8.75	8.77	8.77	8.76
E2	Borley Wood AW	8.70	8.67	8.69	8.69	8.69
E3	Borley Wood AW	8.71	8.69	8.71	8.71	8.71
E4	Balsham Wood AW and SSSI	8.73	8.73	8.76	8.74	8.71
E5	Balsham Wood AW and SSSI	8.64	8.66	8.70	8.66	8.63
E6	Balsham Wood AW and SSSI	8.63	8.63	8.64	8.62	8.62
E7	Over and Lawn Woods SSSI	8.40	8.42	8.40	8.40	8.40
E8	Hare Wood AW	8.62	8.64	8.61	8.61	8.62
E9	Hare Wood AW	8.51	8.52	8.49	8.50	8.50
E10	Hare Wood AW	8.49	8.50	8.48	8.49	8.48
E11	Furze Hill SSSI	9.16	9.16	9.17	9.16	9.16
E12	Furze Hill SSSI	9.17	9.16	9.17	9.16	9.16
E13	Furze Hill SSSI	9.16	9.16	9.17	9.17	9.16

Receptor		Predicted Annual Mean NO_x PEC (µg/m³)				
		2016	2017	2018	2019	2020
E14	Roman Road SSSI	8.88	8.88	8.88	8.88	8.87
E15	Fleam Dyke SSSI	8.84	8.84	8.85	8.84	8.84

3.4.3 As indicated in Table 14, predicted NO_x concentrations were below the annual mean critical level of 30µg/m³ at all ecological receptor locations.

3.4.4 Maximum predicted annual mean NO_x concentrations at the ecological receptor locations are summarised in Table 15.

Table 15 Maximum Predicted Annual Mean NO_x Concentrations: Development Alone

Receptor		Maximum Predicted Annual Mean NO_x Concentration (µg/m³)		Proportion of Critical Level (%)	
		PC	PEC	PC	PEC
E1	Borley Wood AW	0.04	8.77	0.13	29.23
E2	Borley Wood AW	0.06	8.70	0.19	28.99
E3	Borley Wood AW	0.07	8.71	0.24	29.04
E4	Balsham Wood AW and SSSI	0.11	8.76	0.37	29.21
E5	Balsham Wood AW and SSSI	0.16	8.70	0.53	29.00
E6	Balsham Wood AW and SSSI	0.10	8.64	0.32	28.79
E7	Over and Lawn Woods SSSI	0.08	8.42	0.27	28.07
E8	Hare Wood AW	0.10	8.64	0.33	28.80
E9	Hare Wood AW	0.08	8.52	0.27	28.40
E10	Hare Wood AW	0.06	8.50	0.20	28.34
E11	Furze Hill SSSI	0.02	9.17	0.05	30.55
E12	Furze Hill SSSI	0.02	9.17	0.05	30.55
E13	Furze Hill SSSI	0.02	9.17	0.05	30.55
E14	Roman Road SSSI	0.02	8.88	0.08	29.61

Receptor		Maximum Predicted Annual Mean NO_x Concentration ($\mu g/m^3$)		Proportion of Critical Level (%)	
		PC	PEC	PC	PEC
E15	Fleam Dyke SSSI	0.02	8.85	0.05	29.49

3.4.5 As shown in Table 15, PCs were below 1% of the critical level at all SSSIs and 100% of the critical level at all AWs. As such, predicted impacts on annual mean NO_x concentrations as a result of emissions from the development alone are not considered to be significant, in accordance with the stated criteria.

Sulphur Dioxide

3.4.6 Predicted annual mean SO_2 PECs at the ecological receptor locations as a result of emissions from the development alone are summarised in Table 16.

Table 16 Predicted Annual Mean SO_2 Concentrations: Development Alone

Receptor		Predicted Annual Mean SO_2 PEC ($\mu g/m^3$)				
		2016	2017	2018	2019	2020
E1	Borley Wood AW	0.76	0.76	0.76	0.76	0.76
E2	Borley Wood AW	0.75	0.75	0.75	0.75	0.75
E3	Borley Wood AW	0.76	0.75	0.76	0.76	0.76
E4	Balsham Wood AW and SSSI	0.77	0.77	0.78	0.77	0.77
E5	Balsham Wood AW and SSSI	0.76	0.76	0.77	0.76	0.75
E6	Balsham Wood AW and SSSI	0.75	0.75	0.75	0.75	0.75
E7	Over and Lawn Woods SSSI	0.69	0.70	0.69	0.69	0.70
E8	Hare Wood AW	0.73	0.73	0.73	0.73	0.73
E9	Hare Wood AW	0.71	0.71	0.70	0.70	0.70
E10	Hare Wood AW	0.70	0.70	0.70	0.70	0.70
E11	Furze Hill SSSI	0.80	0.80	0.80	0.80	0.80
E12	Furze Hill SSSI	0.80	0.80	0.80	0.80	0.80

Receptor		Predicted Annual Mean SO_2 PEC (µg/m³)				
		2016	2017	2018	2019	2020
E13	Furze Hill SSSI	0.80	0.80	0.80	0.80	0.80
E14	Roman Road SSSI	0.76	0.76	0.77	0.77	0.76
E15	Fleam Dyke SSSI	0.75	0.75	0.75	0.75	0.75

3.4.7 As indicated in Table 16, predicted annual mean SO_2 concentrations were below the annual mean critical level of 10µg/m³ at all ecological receptor locations.

3.4.8 Maximum predicted annual mean SO_2 concentrations at the ecological receptor locations are summarised in Table 17.

Table 17 Maximum Predicted Annual Mean SO_2 Concentrations: Development Alone

Receptor		Maximum Predicted Annual Mean SO_2 Concentration (µg/m³)		Proportion of Critical Level (%)	
		PC	PEC	PC	PEC
E1	Borley Wood AW	0.01	0.76	0.10	7.60
E2	Borley Wood AW	0.01	0.75	0.14	7.54
E3	Borley Wood AW	0.02	0.76	0.19	7.59
E4	Balsham Wood AW and SSSI	0.03	0.78	0.28	7.78
E5	Balsham Wood AW and SSSI	0.04	0.77	0.40	7.70
E6	Balsham Wood AW and SSSI	0.02	0.75	0.24	7.54
E7	Over and Lawn Woods SSSI	0.02	0.70	0.20	7.00
E8	Hare Wood AW	0.02	0.73	0.25	7.35
E9	Hare Wood AW	0.02	0.71	0.19	7.09
E10	Hare Wood AW	0.01	0.70	0.15	7.05
E11	Furze Hill SSSI	0.00	0.80	0.04	8.04
E12	Furze Hill SSSI	0.00	0.80	0.04	8.04
E13	Furze Hill SSSI	0.00	0.80	0.04	8.04

Receptor		Maximum Predicted Annual Mean SO_2 Concentration ($\mu g/m^3$)		Proportion of Critical Level (%)	
		PC	PEC	PC	PEC
E14	Roman Road SSSI	0.01	0.77	0.06	7.66
E15	Fleam Dyke SSSI	0.00	0.75	0.04	7.54

3.4.9 As shown in Table 17, PCs were below 1% of the critical level at all SSSIs and 100% of the critical level at all AWs. As such, predicted effects on annual mean SO_2 concentrations as a result of emissions from the development alone are not considered to be significant, in accordance with the stated criteria.

Ammonia

3.4.10 Predicted annual mean NH_3 concentrations at the ecological receptor locations as a result of emissions from the development alone are summarised in Table 18.

Table 18 Predicted Annual Mean NH_3 Concentrations: Development Alone

Receptor		Predicted Annual Mean NH_3 PEC ($\mu g/m^3$)				
		2016	2017	2018	2019	2020
E1	Borley Wood AW	1.5317	1.5309	1.5316	1.5314	1.5314
E2	Borley Wood AW	1.5424	1.5415	1.5422	1.5421	1.5422
E3	Borley Wood AW	1.5428	1.5419	1.5429	1.5427	1.5425
E4	Balsham Wood AW and SSSI	1.5228	1.5229	1.5241	1.5236	1.5224
E5	Balsham Wood AW and SSSI	1.5144	1.5145	1.5165	1.5152	1.5137
E6	Balsham Wood AW and SSSI	1.5135	1.5133	1.5142	1.5136	1.5130
E7	Over and Lawn Woods SSSI	1.4523	1.4533	1.4523	1.4522	1.4523
E8	Hare Wood AW	1.4731	1.4744	1.4730	1.4731	1.4731
E9	Hare Wood AW	1.4625	1.4633	1.4623	1.4624	1.4623
E10	Hare Wood AW	1.4618	1.4623	1.4616	1.4618	1.4616
E11	Furze Hill SSSI	1.5803	1.5802	1.5803	1.5803	1.5803

Receptor		Predicted Annual Mean NH_3 PEC (µg/m³)				
		2016	2017	2018	2019	2020
E12	Furze Hill SSSI	1.5803	1.5802	1.5803	1.5803	1.5803
E13	Furze Hill SSSI	1.5803	1.5802	1.5803	1.5803	1.5803
E14	Roman Road SSSI	1.5604	1.5604	1.5605	1.5605	1.5604
E15	Fleam Dyke SSSI	1.5203	1.5203	1.5204	1.5203	1.5203

3.4.11 Maximum predicted annual mean NH_3 concentrations at the ecological receptor locations are summarised in Table 19.

Table 19 Maximum Predicted Annual Mean NH_3 Concentrations: Development Alone

Receptor		Maximum Predicted Annual Mean NH_3 Concentration (µg/m³)		Proportion of Critical Level (%)	
		PC	PEC	PC	PEC
E1	Borley Wood AW	0.0016	1.5316	0.16	153.16
E2	Borley Wood AW	0.0022	1.5422	0.22	154.22
E3	Borley Wood AW	0.0029	1.5429	0.29	154.29
E4	Balsham Wood AW and SSSI	0.0041	1.5241	0.41	152.41
E5	Balsham Wood AW and SSSI	0.0065	1.5165	0.65	151.65
E6	Balsham Wood AW and SSSI	0.0042	1.5142	0.42	151.42
E7	Over and Lawn Woods SSSI	0.0033	1.4533	0.33	145.33
E8	Hare Wood AW	0.0044	1.4744	0.44	147.44
E9	Hare Wood AW	0.0033	1.4633	0.33	146.33
E10	Hare Wood AW	0.0023	1.4623	0.23	146.23
E11	Furze Hill SSSI	0.0003	1.5803	0.03	158.03
E12	Furze Hill SSSI	0.0003	1.5803	0.03	158.03
E13	Furze Hill SSSI	0.0003	1.5803	0.03	158.03
E14	Roman Road SSSI	0.0005	1.5605	0.02[a]	52.02

Receptor		Maximum Predicted Annual Mean NH_3 Concentration ($\mu g/m^3$)		Proportion of Critical Level (%)	
		PC	PEC	PC	PEC
E15	Fleam Dyke SSSI	0.0004	1.5204	0.01[(a)]	50.68

NOTE: (a) Assessed against a critical level of 3µg/m³, as obtained from APIS.

3.4.12 As shown in Table 19, PCs were below 1% of the critical level at all SSSIs and 100% of the critical level at all AWs. As such, predicted effects on annual mean NH_3 as a result of emissions from the development alone are not considered to be significant, in accordance with the stated criteria.

Nitrogen Deposition

3.4.13 Predicted annual nitrogen PC deposition rates at the receptor locations as a result of emissions from the development alone are summarised in Table 20.

Table 20 Predicted Annual Nitrogen Deposition Rates: Development Alone

Receptor		Predicted Annual Nitrogen PC Deposition Rate (kgN/ha/yr)				
		2016	2017	2018	2019	2020
E1	Borley Wood AW	26.419	26.412	26.420	26.419	26.418
E2	Borley Wood AW	26.518	26.508	26.517	26.517	26.518
E3	Borley Wood AW	26.523	26.515	26.527	26.525	26.523
E4	Balsham Wood AW and SSSI	26.624	26.629	26.644	26.637	26.621
E5	Balsham Wood AW and SSSI	26.749	26.759	26.783	26.764	26.748
E6	Balsham Wood AW and SSSI	26.741	26.743	26.752	26.745	26.739
E7	Over and Lawn Woods SSSI	32.790	32.802	32.789	32.789	32.791
E8	Hare Wood AW	26.940	26.955	26.937	26.939	26.939
E9	Hare Wood AW	27.062	27.072	27.058	27.061	27.059
E10	Hare Wood AW	27.054	27.060	27.051	27.053	27.051
E11	Furze Hill SSSI	14.823	14.822	14.823	14.823	14.824

Receptor		Predicted Annual Nitrogen PC Deposition Rate (kgN/ha/yr)				
		2016	2017	2018	2019	2020
E12	Furze Hill SSSI	14.823	14.822	14.823	14.823	14.824
E13	Furze Hill SSSI	14.823	14.822	14.823	14.823	14.824
E14	Roman Road SSSI	14.944	14.944	14.945	14.945	14.944
E15	Fleam Dyke SSSI	15.154	15.154	15.155	15.154	15.154

3.4.14 Maximum predicted annual nitrogen deposition rates at the ecological receptor locations are summarised in Table 21.

Table 21 Maximum Predicted Annual Nitrogen Deposition Rates: Development Alone

Receptor		Maximum Predicted Annual Nitrogen Deposition Rate (kgN/ha/yr)		Proportion of Low Critical Load (%)	
		PC	PEC	PC	PEC
E1	Borley Wood AW	0.020	26.420	0.20	264.20
E2	Borley Wood AW	0.028	26.518	0.28	265.18
E3	Borley Wood AW	0.037	26.527	0.37	265.27
E4	Balsham Wood AW and SSSI	0.054	26.644	0.36	177.63
E5	Balsham Wood AW and SSSI	0.083	26.783	0.55	178.55
E6	Balsham Wood AW and SSSI	0.052	26.752	0.35	178.35
E7	Over and Lawn Woods SSSI	0.042	32.802	0.28	218.68
E8	Hare Wood AW	0.055	26.955	0.55	269.55
E9	Hare Wood AW	0.042	27.072	0.42	270.72
E10	Hare Wood AW	0.030	27.060	0.30	270.60
E11	Furze Hill SSSI	0.004	14.824	0.07	296.47
E12	Furze Hill SSSI	0.004	14.824	0.07	296.47
E13	Furze Hill SSSI	0.004	14.824	0.07	296.47
E14	Roman Road SSSI	0.005	14.945	0.05	149.45

Receptor		Maximum Predicted Annual Nitrogen Deposition Rate (kgN/ha/yr)		Proportion of Low Critical Load (%)	
		PC	PEC	PC	PEC
E15	Fleam Dyke SSSI	0.005	15.155	0.05	151.55

3.4.15 As shown in Table 21, PCs were below 1% of the critical load at all SSSIs and 100% of the critical load at all AWs. As such, predicted effects on nitrogen deposition as a result of emissions from the development alone are not considered to be significant, in accordance with the stated criteria.

Acid Deposition

3.4.16 Maximum predicted annual acid deposition rates at the ecological receptor locations as a result of emissions from the development alone are summarised in Table 22.

Table 22 Predicted Annual Acid Deposition Rates: Development Alone

Receptor		Maximum Predicted Annual Acid PC Deposition Rate (keq/ha/yr)		PC Proportion of Critical Load (%)
		Nitrogen	Sulphur	
E1	Borley Wood AW	0.0014	0.0001	0.01
E2	Borley Wood AW	0.0021	0.0001	0.02
E3	Borley Wood AW	0.0026	0.0001	0.03
E4	Balsham Wood AW and SSSI	0.0039	0.0002	0.04
E5	Balsham Wood AW and SSSI	0.0059	0.0002	0.06
E6	Balsham Wood AW and SSSI	0.0037	0.0001	0.04
E7	Over and Lawn Woods SSSI	0.0030	0.0001	0.03
E8	Hare Wood AW	0.0039	0.0001	0.04
E9	Hare Wood AW	0.0030	0.0001	0.03
E10	Hare Wood AW	0.0021	0.0001	0.02
E11	Furze Hill SSSI	0.0003	0.0005	0.02

Receptor		Maximum Predicted Annual Acid PC Deposition Rate (keq/ha/yr)		PC Proportion of Critical Load (%)
		Nitrogen	Sulphur	
E12	Furze Hill SSSI	0.0003	0.0005	0.02
E13	Furze Hill SSSI	0.0003	0.0005	0.02
E14	Roman Road SSSI	0.0004	0.0007	0.02
E15	Fleam Dyke SSSI	0.0005	0.0001	0.01

3.4.17 As shown in Table 22, PCs were below 1% of the critical load at all SSSIs and 100% of the critical load at all AWs. As such, predicted effects on annual acid deposition as a result of emissions from the development alone are not considered to be significant, in accordance with the stated criteria.

In-Combination Assessment

3.4.18 The NE consultation response included a request for a revised In-Combination Assessment for air quality impacts on Over and Lawn Woods SSSI as a result of emissions from the Suffolk AD Plant. The Air Quality Assessment produced by SLR in support of the scheme[14] was therefore reviewed in order to identify predicted PCs from the plant. These are summarised in Table 13.

Table 23 Maximum Predicted PCs from Suffolk AD Plant

Designation	Maximum Predicted PC (µg/m³)		
	Annual Mean NO_x	Annual Mean SO_2	Annual Mean NH_3
Over and Lawn Woods SSSI	0.2	0.01	0.01

3.4.19 The assessment was based on the maximum predicted PCs and impacts at individual receptors were not predicted. As such, the concentrations shown in Table 13 represent worst-case changes in pollutant concentrations and are likely to represent the closest point of the designation to the Suffolk AD Plant.

[14] Spring Grove Green Power – Air Quality Assessment: 404.11923.00004 Phase 14, SLR, 2023.

3.4.20 It is noted that the Air Quality Assessment[15] is currently subject to a 'further information' request from NE (reference: 451923). This relates to additional detail in relation to the treatment of a number of emission sources within the model, as well as a requirement for an In-Combination Assessment. Given the limited headroom between the predicted annual mean NH_3 PC and the relevant screening criterion, it is considered likely that the Applicant will be required to resolve these issues favourably to avoid prediction of a likely significant effect on Over and Lawn Woods SSSI. As such, the results of Air Quality Assessment[16] are considered to provide suitable inputs for the In-Combination Assessment. Additionally, they represent the most up to date information available regarding the relevant project at the time of reporting. It would therefore not be reasonable to discount the values in preference to assumptions with a much greater level of uncertainty.

3.4.21 Over and Lawn Woods SSSI is approximately 1.76km in length, with the proposed development located to the west and Suffolk AD Plant to the east. As such, the location where maximum changes in pollution levels occur as a result of each scheme will differ. In order to allow PCs from each project to be combined for comparison with the NE criterion, two additional discrete receptors were defined. These were positioned at the points of maximum predicted PCs in relation to emissions from the two sites associated with the Suffolk AD plant, as derived from the contour plots contained within the Air Quality Assessment. These are summarised in Table 24.

Table 24 Additional Over and Lawn Woods SSSI Receptor Locations

Receptor		NGR (m)	
		X	Y
E16	Over and Lawn Woods SSSI	563848.5	248118.1
E17	Over and Lawn Woods SSSI	563790.8	248819.0

3.4.22 The model was run to predict PCs from the proposed development at the two additional receptors. These were subsequently added to the PCs from the Suffolk AD Plant summarised in Table 13 to determine total in-combination PCs. Predicted annual mean NO_x concentrations are summarised in Table 25.

15 Spring Grove Green Power – Air Quality Assessment: 404.11923.00004 Phase 14, SLR, 2023.

16 Spring Grove Green Power – Air Quality Assessment: 404.11923.00004 Phase 14, SLR, 2023.

Table 25 Predicted Annual Mean NO_x Concentrations - Development In-Combination

Receptor		Predicted Annual Mean NO_x Concentration (µg/m³)			PC as Prop. Of CL (%)
		Proposed Development	Suffolk AD Plant	Total PC	
E16	Over and Lawn Woods SSSI	0.03	0.20	0.23	0.78
E17	Over and Lawn Woods SSSI	0.04	0.20	0.24	0.79

3.4.23 As shown in Table 25, PCs were below 1% of the critical level at Over and Lawn Woods SSSI. As such, predicted effects on annual NO_x concentrations as a result of emissions from the development in-combination with other relevant plans and projects are not considered to be significant, in accordance with the stated criteria.

3.4.24 Predicted annual mean SO_2 concentrations are summarised in Table 26.

Table 26 Predicted Annual Mean SO_2 Concentrations - Development In-Combination

Receptor		Predicted Annual Mean SO_2 Concentration (µg/m³)			PC as Prop. Of CL (%)
		Proposed Development	Suffolk AD Plant	Total PC	
E16	Over and Lawn Woods SSSI	0.01	0.01	0.02	0.19
E17	Over and Lawn Woods SSSI	0.01	0.01	0.02	0.19

3.4.25 As shown in Table 26, PCs were below 1% of the critical level at Over and Lawn Woods SSSI. As such, predicted effects on annual SO_2 concentrations as a result of emissions from the development in-combination with other relevant plans and projects are not considered to be significant, in accordance with the stated criteria.

3.4.26 Predicted annual mean NH_3 concentrations are summarised in Table 27.

Table 27 Predicted Annual Mean NH_3 Concentrations - Development In-Combination

Receptor		Predicted Annual Mean NH_3 Concentration (µg/m³)			PC as Prop. Of CL (%)
		Proposed Development	Suffolk AD Plant	Total PC	
E16	Over and Lawn Woods SSSI	0.0012	0.0080	0.0092	0.92
E17	Over and Lawn Woods SSSI	0.0014	0.0080	0.0094	0.94

3.4.27 As shown in Table 27, PCs were below 1% of the critical level at Over and Lawn Woods SSSI. As such, predicted effects on annual NH_3 concentrations as a result of emissions from the development in-combination with other relevant plans and projects are not considered to be significant, in accordance with the stated criteria.

3.4.28 Predicted annual nitrogen deposition rates are summarised in Table 28.

Table 28 Predicted Annual Nitrogen Deposition - Development In-Combination

Receptor		Predicted Annual Nitrogen PC Deposition Rate (kgN/ha/yr)			PC as Prop. Of CL (%)
		Proposed Development	Suffolk AD Plant	Total PC	
E16	Over and Lawn Woods SSSI	0.013	0.075	0.088	0.59
E17	Over and Lawn Woods SSSI	0.015	0.074	0.089	0.60

3.4.29 As shown in Table 28, PCs were below 1% of the critical load at Over and Lawn Woods SSSI. As such, predicted effects on annual nitrogen deposition as a result of emissions from the development in-combination with other relevant plans and projects are not considered to be significant, in accordance with the stated criteria.

3.4.30 Predicted annual acid deposition rates are summarised in Table 29.

Table 29 Predicted Annual Acid Deposition - Development In-Combination

Receptor		Predicted Annual Acid PC Deposition Rate (keq/ha/yr)			PC as Prop. Of CL (%)
		Proposed Development	Suffolk AD Plant	Total PC	
E16	Over and Lawn Woods SSSI	0.0117	0.0086	0.020	0.19
E17	Over and Lawn Woods SSSI	0.0134	0.0087	0.022	0.20

3.4.31 As shown in Table 29, PCs were below 1% of the critical load at Over and Lawn Woods SSSI. As such, predicted effects on annual acid deposition as a result of emissions from the development in-combination with other relevant plans and projects are not considered to be significant, in accordance with the stated criteria.

3.5 Summary

3.5.1 The results of the assessment can be summarised as follows:

- Dispersion modelling was undertaken to determine PCs as a result of the development alone at ecological receptors in the vicinity of the site. The results indicated that PCs of all pollutants were below 1% of the relevant critical load or level at all SSSIs and below 100% of the relevant critical load or level at all AW. As such, a conclusion of no significant effect could be reached as a result of the development alone; and,
- One project was identified which has the potential to cause in-combination effects. Review of the Air Quality Assessment undertaken in support of the scheme[17] was undertaken to determine maximum PCs at Over and Lawn Woods SSSI. These were subsequently added to predicted PCs from the development alone to determine total in-combination PCs. The results indicated that PCs of all pollutants were below 1% of the relevant critical load or level. As such, a conclusion of no significant effect could be reached as a result of the development in-combination with other plans and projects.

[17] Spring Grove Green Power – Air Quality Assessment: 404.11923.00004 Phase 14, SLR, 2023.

3.5.2 As shown above, a conclusion of no significant effect as a result of the development both alone and in-combination could be reached with regard to impacts on Over and Lawn Woods SSSI. Further assessment was not therefore required.

4.0 ABBREVIATIONS

AD	Anaerobic Digestion
APIS	Air Pollution Information System
AW	Ancient Woodland
CERC	Cambridge Environmental Research Consultants
CHP	Combined Heat and Power
EA	Environment Agency
ELV	Emission Limit Value
NE	Natural England
NGR	National Grid Reference
NH_3	Ammonia
NO_x	Oxides of nitrogen
NRW	Natural Resources Wales
PC	Process Contribution
PEC	Predicted Environmental Concentration
PTH	Power to Heat
SO_2	Sulphur dioxide
SSSI	Site of Special Scientific Interest