PROPOSED ANAEROBIC DIGESTION FACILITY AT SPRING GROVE FARM, WITHERSFIELD, NORTHWEST OF HAVERHILL, CB9 7SW

Air Quality Assessment

Prepared for: Acorn Bioenergy Limited

Client Ref: Spring Grove Green Power

SLR Ref: 404.11923.00004 Phase 14
Version No: v1.7
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BASIS OF REPORT

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EXECUTIVE SUMMARY

This Air Quality Assessment has assessed the potential impacts on air quality and local amenity associated with the Proposed Development of an Anaerobic Digestion (AD) facility on land north of the A1307, approximately 3km east of Haverhill town centre, referred to as Spring Grove Green Power.

The potential impact associated with odour, dust, road traffic, bioaerosols, ammonia and Combined Heat and Power (CHP) combustion emissions on both human and ecological receptors has been assessed.

The AD facility would accept in the region of 92,000 tonnes per annum of feedstock from local farms. The facility would harvest biogas from the digestion of the feedstock types received, for upgrade and eventual off-site export as biomethane. Site facilities include storage facilities for the incoming feedstock types, digestors, digestate lagoons, digestate separator and a power generation unit (comprising two CHP engines).

The construction phase assessment has concluded that the construction of the Proposed Development would result in a ‘not significant’ risk of impacts.

The operational phase assessment has concluded that the Proposed Development would result in a ‘not significant’ effect at human receptor locations with regard to odour, dust, ammonia, CHP and traffic emissions bioaerosols emissions screen out of the need for further assessment according to EA guidelines. With regard to ecological receptors the process emissions are considered to cause ‘no likely damage’ to the Over and Lawn Woods SSSI and ‘no significant pollution’ at the surrounding Ancient Woodlands.

1.0 INTRODUCTION

SLR Consulting Limited (SLR) has been instructed by Acorn Bioenergy Ltd ('the client') to undertake an Air Quality Assessment (AQA) in support of their planning application for an Anaerobic Digestion (AD) facility (the 'Proposed Development') on land north of the A1307, approximately 3km east of Haverhill town centre, referred to as Spring Grove Green Power.

The assessment describes the scope, relevant legislation, assessment methodology and the baseline conditions currently existing in the area. It then presents the potential impacts of the Proposed Development and an evaluation of the significance of effects.

1.1 Proposed Development

The AD facility would accept in the region of 92,000 tonnes per annum of feedstock from local farms. The facility would harvest biogas from the digestion of the feedstock types received, for upgrade and eventual off-site export as biomethane. Site facilities include storage facilities for the incoming feedstock types, digestors, digestate lagoons, digestate separator and a power generation unit (comprising two Combined Heat and Power (CHP) engines).

1.2 Scope and Objective

This report considers the potential for the Proposed Development to impact upon local air quality and amenity in the vicinity of the Site.

The scope of the assessment comprises the following components:

- review of relevant local and national policy;
- baseline assessment – existing air quality in the local area;
- construction phase assessment – potential effects arising from construction activities, primarily dust and traffic emissions;
- operational phase assessment – potential effects arising as a result of odour, dust, bioaerosols, ammonia, and combustions emissions (from power generation and traffic);
- recommendation of mitigation measures, as appropriate.

The Environmental Health department at West Suffolk Council (WSC) was consulted on the methodology and scope of the assessments. A response received from the Environmental Health Officer (EHO) raised no "comments or questions" regarding the proposed methodology and scope of assessment.

2.0 RELEVANT LEGISLATION, POLICY & GUIDANCE

2.1 Legislative Context

2.1.1 Air Quality Strategy

The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales, and Northern Ireland (AQS) most recently updated in July 2007. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK.

The AQS sets standards and objectives for ten priority pollutants. Standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. Objectives are policy targets often expressed as maximum concentrations not to be exceeded either without exception or with a limited number of exceedances within a specified timescale.

The strategy objectives for the pollutants considered in this report are shown in Table 2-1.

2.1.2 Air Quality Regulations

The Air Quality Standards Regulations 2010 (the regulations) include Limit Values, Target Values, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment (collectively termed Air Quality Assessment Levels (AQAL) throughout this report). Those relevant to this Air Quality Assessment are presented within Table 2-1.

2.1.3 Local Air Quality Management (LAQM)

Section 82 of the Environment Act 1995 (Part IV) requires local authorities to periodically review and assess the quality of air within their administrative area. The reviews consider the present and future air quality and whether any AQALs prescribed in regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed AQALs are not likely to be achieved the authority concerned must designate an Air Quality Management Area (AQMA). For each AQMA the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the AQAL. As such, Local Authorities (LAs), have formal powers to control air quality through a combination of LAQM and by use of their wider planning policies.

Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their LAQM work[1]. This guidance, referred to in this report as LAQM.TG(22), has been used where appropriate in the assessment presented here.

2.1.4 General Nuisance Legislation

Part III of the Environmental Protection Act (EPA) 1990 (as amended) contains the main legislation on Statutory Nuisance and allows local authorities and individuals to take action to prevent a statutory nuisance. Section 79 of the EPA defines, amongst other things, smoke, fumes, dust and smells emitted from industrial, trade or business premises so as to be prejudicial to health or a nuisance, as a potential Statutory Nuisance.

Fractions of dust greater than 10µm (i.e. greater than PM_{10}) in diameter typically relate to nuisance effects as opposed to potential health effects and therefore are not covered within the UK AQS. In legislation, there are currently no numerical limits in terms of what level of dust deposition constitutes a nuisance.

[1] Department for Environment, Food and Rural Affairs (DEFRA): Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(22), 2022.

2.1.5 Protection of Ecological Receptors

Sites of nature conservation importance at a European, national and local level, are provided environmental protection from developments, including from atmospheric emissions via the following legislation:

- Conservation of Habitats and Species Regulations 2017 ('Habitats Regulations') as amended
- Wildlife & Countryside Act 1981.

2.1.6 Environmental Permitting Regulations

The AD Facility is a type of operation that would be regulated under the Environmental Permitting (England and Wales) Regulations 2016 (as amended). The EP Regulations include requirements on operating conditions, monitoring and Emission Limit Values (ELVs) that would be incorporated into the site's Permit and would be enforceable by the Environment Agency (EA).

Various guidance documents are provided by the EA with respect the operation and assessment of impacts from facilities regulated under EP Regulation. Key to air quality assessments is the 'Air Emissions Risk Assessment for your Environmental Permit' (AERA) guidance. The AERA guidance provides Environmental Assessment Levels (EALs) for pollutants not covered under the AQS or AQSR, such as ammonia and guidance on assessing impacts on ecological receptors. Other guidance documents address assessment of risks from bioaerosols.

2.2 Environmental Standards

2.2.1 Standards for the Protection of Human Health

The standards applied in this assessment are shown in Table 2-1.

Table 2-1
Applied Air Quality Assessment Levels

Pollutant	Standard ($\mu g/m^3$)	Measured As		Ref.
Nitrogen Dioxide (NO_2)	40	Annual Mean	-	AQS
	200	1-hour Mean	not to be exceeded more than 18 times per year	
Sulphur Dioxide (SO_2)	125	24-hour Mean	not to be exceeded more than 3 times a calendar year	
	350	1-hour Mean	not to be exceeded more than 24 times a calendar year	
	266	15-minute mean	not to be exceeded more than 35 times a calendar year	
Particles (PM_{10})	40	Annual Mean	-	
	50	24-hour mean	not to be exceeded more than 24 times a calendar year	
Particles ($PM_{2.5}$)	20	Annual Mean	-	
Ammonia (NH_3)	180	Annual Mean	-	AERA
	2,500	1-hour Mean	-	

In accordance with the Defra technical guidance on Local Air Quality Management (LAQM.TG(122)), the AQALs should be assessed at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. A summary of relevant exposure for the objectives presented in Table 2-1 are shown below in Table 2-2.

Table 2-2
Human Health Relevant Exposure

AQAL Averaging Period	Relevant Locations	AQALs should apply at	AQALs should not apply at
Annual Mean	Where individuals are exposed for a cumulative period of 6-months in a year	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
24-hour mean	Where individuals may be exposed for eight hours or more in a day	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
1-hour mean	Where individuals might reasonably be expected to spend one hour or longer	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access
15-minute Mean	Where individuals might reasonably be expected to spend 15-minutes or longer	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	-

2.2.2 Standards for the Protection of Ecosystems and Vegetation

2.2.3 Critical Levels (C_{Le})

C_{Le}'s are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The relevant C_{Le} for the protection of vegetation and ecosystems is specified within the UK air quality regulations and AERA guidance.

Table 2-3
Relevant C_{Le} for the Protection of Vegetation and Ecosystems

Pollutant	Concentration (µg/m^3)	Habitat and Averaging Period
Nitrogen oxides (NOx)	30	Annual mean (all ecosystems)
	75 (A)	Daily mean (all ecosystems)
Ammonia (NH_3)	3.0 (B)	Annual mean
Sulphur dioxide (SO_2)	10	Annual mean (where lichens or bryophytes are present)
	20	Annual mean (all ecosystems)
Table note:		

Pollutant	Concentration (µg/m^3)	Habitat and Averaging Period
(A) The 24-hour mean NOx critical level is 75 µg/m^3, with the exception that 200 µg/m^3 may be applied where the ozone is below the AOT40 critical level (18,000 µg/m^3 over the past 5 years) and sulphur dioxide is below the lower critical level (10 µg/m^3). (B) A more stringent level (1.0 µg/m^3) applies where lichens and bryophytes form a key part of the ecosystem integrity.		

2.2.4 Critical Loads (C_{Lo})

C_{Lo}'s are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Critical loads are set for the deposition of various substances to sensitive ecosystems. In relation to combustion emissions, critical loads for eutrophication and acidification are relevant. Eutrophication and acidification can occur via both wet and dry deposition; however on a local scale only dry (direct deposition) is considered significant. The UK Air Pollution Information System (APIS) website (www.apis.ac.uk/) has been consulted for relevant C_{Lo}'s for the sites subject to assessment (presented in Section 4.4).

2.3 Planning Policy

2.3.1 National Policy

The 2021 update to the National Planning Policy Framework (NPPF) describes the policy context in relation to pollutants including air pollutants:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of […] air […] pollution […]. Development should, wherever possible, help to improve local environmental conditions such as air […] quality […]"*
>
> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development."*

Specifically, in terms of development with regards to air quality:

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

The NPPF is accompanied by supporting Planning Practice Guidance[2] (PPG) which includes guiding principles on how planning can take account of the impacts of new development on air quality. The November 2019 update to the PPG includes the following in regard to air quality:

> *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species)."*

The PPG sets out the information that may be required within the context of a supporting air quality assessment, stating that "*Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions) […] Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact*".

The policies within the NPPF and accompanying PPG in relation to air pollution are considered within this assessment.

2.3.2 Local Policy

Whilst the application is submitted to Suffolk County Council, the Site lies within the administrative area of WSC, which was established on the 1st of April 2019. WSC is made up of the former administrative areas of Forest Heath District Council (FHDC) and St Edmundsbury Borough Council (SEBC), therefore the local plan for WSC is formed from a joint development plan which conforms with the core strategies for both FHDC[3] and SEBC[4]. The Joint Development Management Policies Document (JDMPD)[5] was developed in February 2015. The JDMPD presents the strategy for the development and use of land in the district, as well as containing the policies for delivering these objectives. It is also noted that at the time of writing, the West Suffolk Local Plan is under review, consultation to be concluded by 26th July, to establish the long term planning and land use policies for the area.

The following policy of the JDMPD was identified to be of direct relevance to this assessment:

Policy DM14: Protecting and Enhancing Natural Resources, Minimising Pollution and Safeguarding from Hazards:

> *"Development will not be permitted where, individually or cumulatively, there are likely to be unacceptable impacts arising from the development on:*
>
> - *the natural environment, general amenity and the tranquillity of the wider rural area;*
> - *health and safety of the public;*
> - *air quality; or*
> - *[…]*
> - *compliance with statutory environmental quality standards."*

Consideration has been given to the above policy within this assessment.

2.4 Assessment Guidance

The air quality assessment has been carried out with reference to the principles contained within the following guidance documents:

- Defra: Local Air Quality Management Technical Guidance (LAQM.TG(22));

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2 Planning Practice Guidance Air Quality (2014) (June 2021 Update) Ministry of Housing, Communities and Local Government. https://www.gov.uk/government/collections/planning-practice-guidance
3 Forest Heath Local Development Framework, Adopted May 2010.
4 Local Development Framework, St Edmundsbury Core Strategy, Adopted December 2010.
5 Forest Heath and St Edmundsbury Local Plan, Joint Development Management Policies Document, Adopted February 2015

- Defra: COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021[6];
- IAQM: Use of 2020 and 2021 Monitoring Datasets[7];
- Environmental Protection UK (EPUK) and the Institute of Air Quality Management Guidance (IAQM): Land-Use Planning and Development Control: Planning for Air Quality[8];
- IAQM: Guidance on the Assessment of Dust from Demolition and Construction[9];
- IAQM: Guidance on the assessment of odour for planning[10];
- IAQM: Guidance on the Assessment of Mineral Dust Impacts for Planning[11];
- EA position statement 031: Composting and potential health effects from bioaerosols;
- EA: Air emissions risk assessment for your environmental permit;
- European Monitoring and Evaluation Programme (EMEP) and the European Environment Agency (EEA): Air Pollutant Emission Inventory Guidebook[12];
- Ammonia Mitigation User Manual[13];
- Ammonia emissions from UK non-agricultural sources in 2017[14];
- EA Operational Instruction 66_12[15]; and
- The EA AQTAG.06[16] guidance for assessing impacts on ecological sites.

[6] DEFRA and the Greater London Authority, COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021. April 2021.
[7] Use of 2020 and 2021 monitoring datasets, August 2021, Version 1.0. Institute of Air Quality Management. Available at: https://iaqm.co.uk/wp-content/uploads/2013/02/IAQM_2020_and_2021_monitoring_datasets.pdf.
[8] EPUK and IAQM, Land-Use Planning and Development Control: Planning for Air Quality, 2017.
[9] IAQM, Guidance on the Assessment of Dust from Demolition and Construction, v1.1, 2016.
[10] IAQM, Guidance on the assessment of odour for planning, Version 1.1, July 2018.
[11] IAQM, Guidance on the Assessment of Mineral Dust Impacts for Planning, v1.1, 2016.
[12] EMEP/EEA Air Pollutant Emission Inventory Guidebook, Appendix 5.B.2 (Biological treatment of waste), 2019.
[13] Ammonia Mitigation User Manual, Misselbrook, 2008.
[14] Ammonia emissions from UK non-agricultural sources in 2017, Centre for Ecology & Hydrology, 2018.
[15] EA Operational Instruction 66_12: Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation'.
[16] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014 version.

3.0 ASSESSMENT METHODOLOGY

3.1 Assessment of Construction Dust

A construction dust assessment has been undertaken with reference to IAQM guidance. The assessment of risk is determined by considering the risk of dust effects arising from four activities in the absence of mitigation:

- demolition;
- earthworks;
- construction; and
- construction vehicle track-out.

The assessment methodology considers three separate dust impacts with account being taken of the sensitivity of the area that may experience these effects:

- annoyance due to dust soiling;
- the risk of health effects due to an increase in exposure to PM_{10}; and
- harm to ecological receptors.

The first stage of the assessment involves a screening to determine if there are sensitive receptors within threshold distances of the site activities associated with the construction phase of the scheme. A detailed assessment is required where a:

- human receptor is located within 350m of the Site, and/or within 50m of routes used by construction vehicles, up to 200m from the site entrance(s); and/or
- ecological receptor is located within 50m of the Site, and/or within 50m of routes used by construction vehicles, up to 200m from the site entrance(s).

The dust emission class (or magnitude) for each activity is determined on the basis of the guidance, indicative thresholds and professional judgement. The risk of dust effects arising is based upon the relationship between the dust emission magnitude and the sensitivity of the area. The risk of impact is then used to determine the appropriate mitigation requirements, whereby through effective application, residual effects are considered to be 'not significant'.

3.2 Road Traffic Emissions

The assessment of air quality effects in relation to traffic generated during the construction and operational phase of the Proposed Development has been screened in accordance with the EPUK-IAQM and DMRB guidance. This comprises a two-staged screening process to identify where further assessment is required. If the Proposed Development does not meet exceed the screening criteria, then effects are considered insignificant.

The applied screening procedure is as follows:

- Stage 1: Comparison of road traffic trips generated by the Proposed Development with reference to EPUK-IAQM thresholds to determine the extent of the affected road network:
  - within or adjacent to an AQMA:
    - a change of Light-Duty Vehicle (LDV) flows of more than 100 Annual Average Daily Traffic (AADT); and/or
    - a change of Heavy-Duty Vehicle (HDV) flows of more than 25 AADT.
  - outside of an AQMA:
    - a change of LDV flows of more than 500 AADT; and/or
    - a change of HDV flows of more than 100 AADT.

- Stage 2: Spatial review with use of satellite imagery to determine whether exposure exists within 200m of an affected road (as per the DMRB LA 105).

3.3 Assessment of Odour

The assessment of fugitive odour emissions from the operation of the Proposed Development has been undertaken on the basis of a conceptual model, as per the IAQM odour guidance[10], that takes into consideration the potential sources, surrounding receptors and the pathway between source and receptor in order to assess the magnitude of risk.

Specifically the following aspects are reviewed:

- the type of activities proposed on site including designed-in mitigation measures in order to determine:
  - the potential magnitude of releases in general terms; and
  - the nature of that release.
- the location of receptors in the surrounding area with specific consideration of the type of receptor and therefore their potential sensitivity according to guidance; and
- the pathway between source and receptors incorporating distance between receptors and any mitigating features as well as the frequency of wind conditions likely to result in the dispersion of emissions towards receptors.

3.4 Assessment of Dust

The assessment of fugitive dust emissions from the Proposed Development has been undertaken on the basis of a conceptual model that takes into consideration the potential sources, surrounding receptors and the pathway between source and receptor in order to assess the magnitude of risk.

Specifically the following aspects are reviewed:

- the type of activities proposed on site including designed-in mitigation measures in order to determine:
  - the potential magnitude of releases in general terms; and
  - the nature of that release.
- the location of receptors in the surrounding area with specific consideration of the type of receptor and therefore their potential sensitivity to dust; and
- the pathway between source and receptors incorporating buffer distance between receptors and any mitigating features as well as the frequency of wind conditions likely to result in the dispersion of emissions towards receptors (the assessment matrix draws on IAQM dust guidance[11]).

3.5 Assessment of CHP Emissions

The emission parameters for the two CHPs have been determined in reference to the manufacturer's datasheet.

In accordance with the EA's AERA guidance and the additional guidance provided by the Air Quality Modelling and Assessment Unit (AQMAU) of the EA, a detailed dispersion modelling assessment has been undertaken to assess the impact of CHP emissions from the Proposed Development. The model has been used to predict ground level concentrations for comparison against AQALs, Critical Loads and Critical Levels.

In addition to the AERA guidance, the EA's Operational Instruction 66_12[17] details how air quality impacts on ecological sites should be assessed. This guidance provides risk-based screening criteria to determine whether impacts will have 'no likely significant effects' for European sites, 'no likely damage' for Sites of Special Scientific Interest (SSSIs), or 'no significant pollution' for other sites, as follows:

- PC does not exceed 1% long-term C_{Le} and/or C_{Lo} or that the PEC does not exceed 70% long-term C_{Le} and/or C_{Lo} for European sites and SSSIs; and
- PC does not exceed 10% short-term C_{Le} for NO_x for European sites and SSSIs;
- PC <100% long-term C_{Le} and/or C_{Lo} for other conservation sites; and
- PC <100% short-term C_{Le} for NO_x (if applicable) for other conservation sites.

3.6 Assessment of Bioaerosols

In lieu of sector-specific or planning-specific guidance on the assessment of bioaerosols from Anaerobic Digestion, the EA's regulatory position on the assessment of bioaerosols from composting has been adopted. The EA's position is that the requirement for assessment of bioaerosols emissions can be screened out where potential source of bioaerosols are located at a distance of 250m or more from sensitive receptors (such as workplaces or dwellings).

Although it is noted that guidance was produced in consideration of open-air composting operations, adoption of this approach represents a conservative assessment approach as the Proposed Development is anticipated to have a lesser potential for the release of bioaerosols in comparison to open composting operations.

3.7 Assessment of Ammonia

Ammonia emissions from the feedstocks, liquid digestate and solid digestate have been derived in application of the methodology outlined in section 5.B.2 of the EMEP Air Pollutant Emission Inventory Guidebook.

In accordance with the EA's AERA guidance and the additional guidance provided by the AQMAU of the EA, a detailed dispersion modelling assessment has been undertaken to assess the impact of NH_3 emissions from the Proposed Development. The model has been used to predict ground level concentrations for comparison against AQALs, Critical Loads and Critical Levels. The assessment of NH_3 is also subject to the same Operational Instruction 66_12 as detailed in Section 3.5.

[17] EA Operational Instruction 66_12 - Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Issued 08/05/2012.

4.0 BASELINE ENVIRONMENT

4.1 Site Setting and Sensitive Receptors

The Proposed Development comprises two sites; here on in referred to as 'Site 1' and 'Site 2'. Site 1 is located at approximate National Grid Reference (NGR): x564200 y246900, and Site 2 is located at approximate NGR: x564250 y249550. Both Sites are located within the administrative area of WSC and is not located within, or in proximity of, an AQMA.

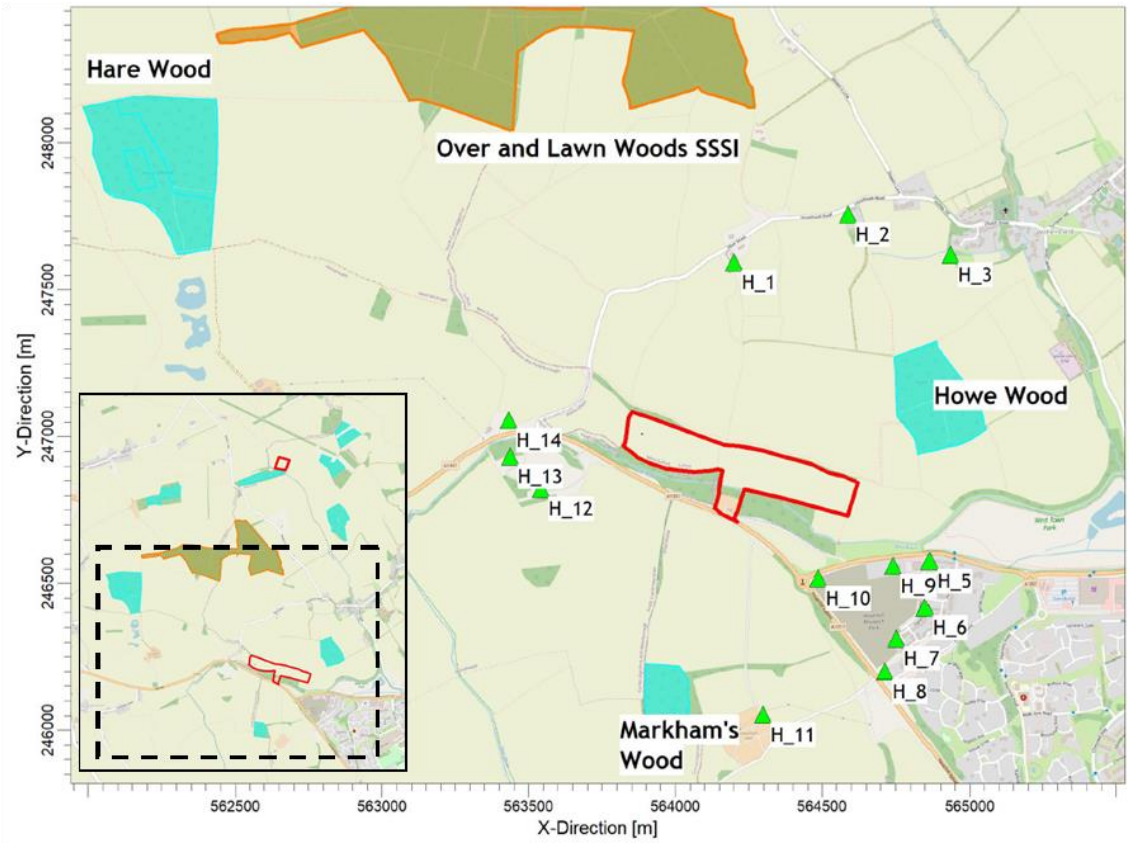
Site 1 comprises two adjoining fields approximately 9.3ha of which at Bowsey Field and 3.2ha at Spring Grove Field, accessed off the A1307. Site 1 is surrounded by rural agricultural land with isolated commercial and residential properties. A more densely populated residential area, Three Counties Way, is located approximately 420m to the southeast of Site 1.

Site 2, a 2ha arable field along Stour Brook, is surrounded by rural agricultural land with isolated residential properties located along Skippers Lane, located approximately 640m to the south and west.

A pipeline would connect Site 1 and Site 2, facilitating the transfer of liquid digestate between the Sites. It should be noted that the pipeline has been assessed in isolation within a separate AQA[18].

There are a number of ecological sites in proximity to the Proposed Development, including Ancient Woodlands. (AW) and the Over and Lawn Wood Site of Special Scientific Interest (SSSI).

Figure 4-1 and Figure 4-2 below present the Proposed Development boundary (red outlines), nearest sensitive human receptors (green triangles) and sensitive ecological receptors (blue shaded areas).



[18] SLR report: "404.V11923.00004_Pipeline_AQA"

Figure 4-1
Site Setting & Sensitive Receptors

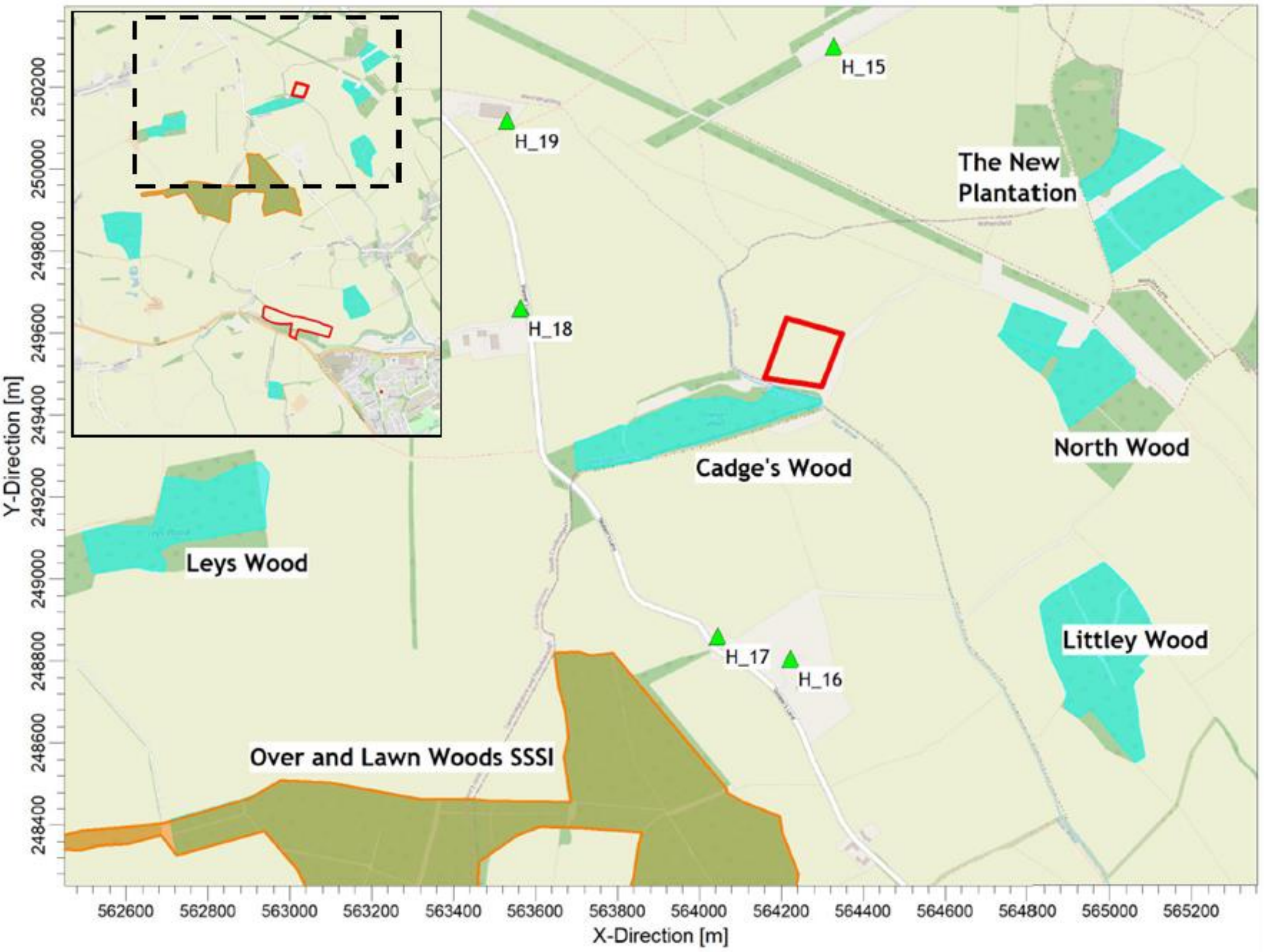
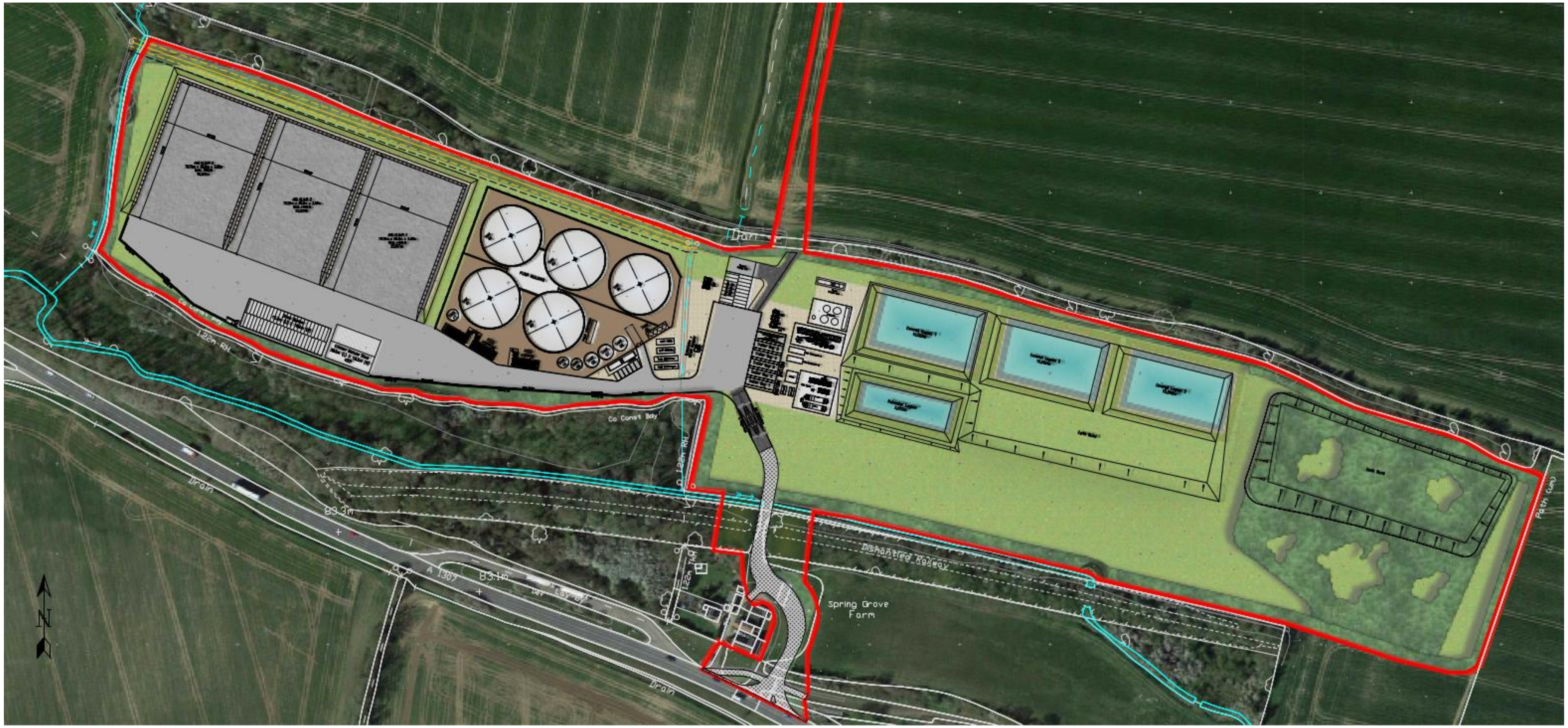


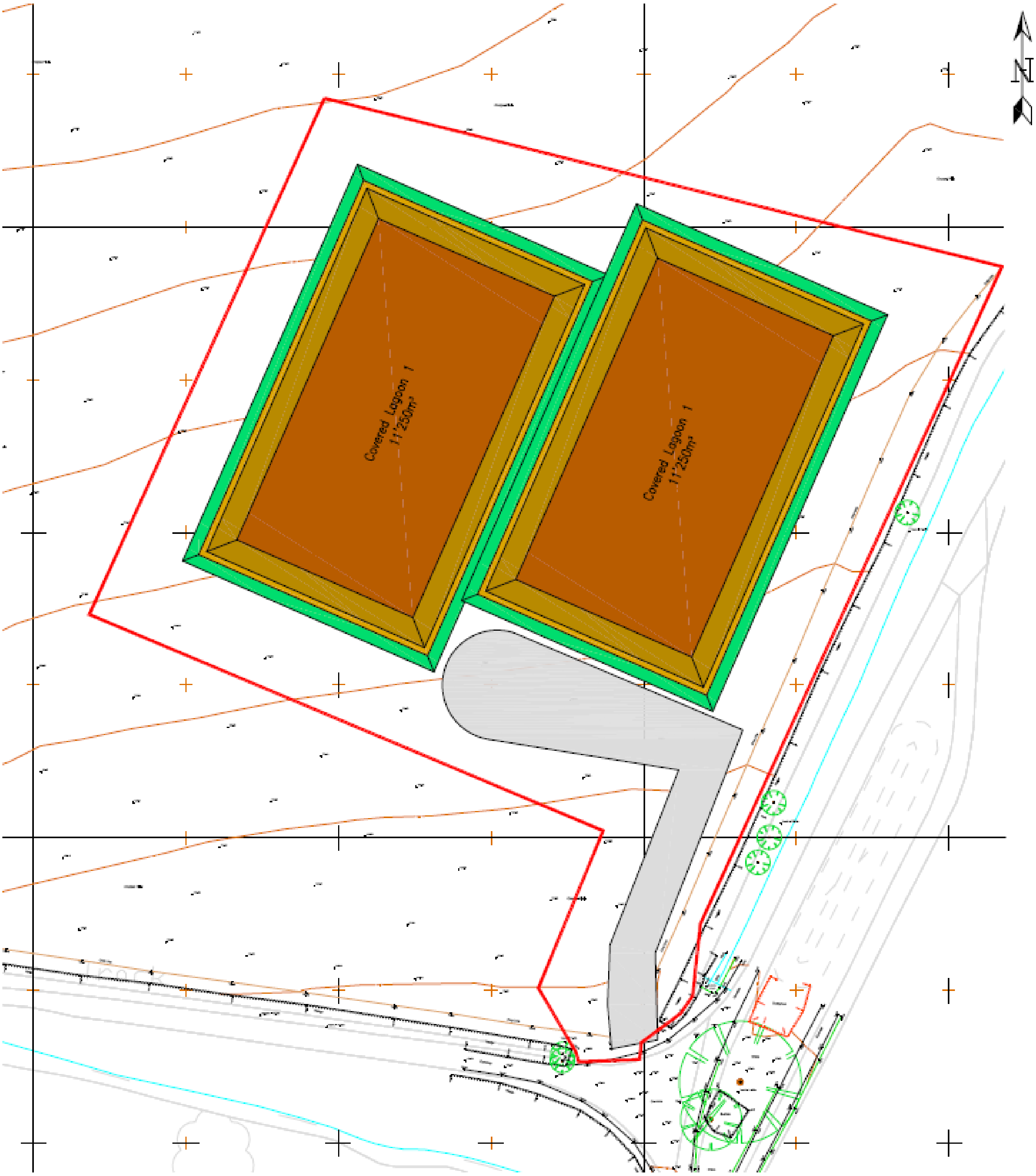
Figure 4-2
Proposed Layout

Figure 4-1 and Figure 4-2 present the proposed layout of Site 1 and Site 2.



Credit: GGP Consult, drawing reference: 29351/101 Rev U

Figure 4-3
Proposed Layout – Site 1



Credit: GGP Consult, drawing reference: 29351/600 Rev. C

Figure 4-4
Proposed Layout – Site 2

4.1.1 Human Receptors

Receptors in proximity to the Proposed Development with a sensitivity to emissions have been identified and presented in Table 4-1. The selection of human receptors has considered the closest receptor locations in each direction (of Site 1 and Site 2) to provide a precautionary assessment representative of the general scale of impacts. According to LAQM.TG(22), air quality AQALs should only apply to locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant AQAL. The sensitivity applied to each receptor (where applicable) has been determined based upon the relevant IAQM guidance.

Table 4-1
Human Receptor Locations

Receptor		In Proximity to Site	Receptor Type	Sensitivity to Odour	Sensitivity to Dust	Direction from Site Boundary	Distance from Site Boundary
H 1	Silver Street	Site 1	Residential	High	High	N	620m
H 2	Horseheath Rd	Site 1	Residential	High	High	N	830m
H 3	Homestall Crescent	Site 1	Residential	High	High	NE	830m
H 4	Queen Street	Site 1	Residential	High	High	E	940m
H 5	Three Counties Way	Site 1	Residential	High	High	SE	320m
H 6	Darwin Walk	Site 1	Residential	High	High	SE	410m
H 7	Darwin Walk	Site 1	Residential	High	High	SE	460m
H 8	Hanchett End	Site 1	Residential	High	High	SSE	550m
H 9	The Flying Shuttle	Site 1	Commercial	Medium	Medium	SE	240m
H 10	The Epicentre Haverhill	Site 1	Commercial	Medium	Medium	SE	210m
H 11	Hatchet Hall Cattery and Kennels	Site 1	Commercial	Medium	Medium	S	690m
H 12	Off A1307	Site 1	Residential	High	High	SW	320m
H 13	Off A1307	Site 1	Residential	High	High	WSW	390m
H 14	Off A1307	Site 1	Residential	High	High	W	400m
H 15	Unnamed road	Site 2	Commercial	Medium	Medium	N	680m
H 16	Skipper's Lane	Site 2	Residential	High	High	S	670m
H 17	Skipper's Lane	Site 2	Residential	High	High	SSW	650m
H 18	Skipper's Lane	Site 2	Residential	High	High	W	630m
H 19	Skipper's Lane	Site 2	Residential	High	High	NW	830m

4.1.2 Ecological Receptors

The AERA Guidance requires that ecological habitats should be screened against relevant standards if they are located within the following set distances from the Proposed Development:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 10km of the installation; and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNR), Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and Ancient Woodland (AW) within 2km of the installation.

A review using the Magic web-based mapping service[19] and Natural England open data publication[20] was undertaken to identify any designated sites of ecological or nature conservation importance required for consideration within the assessment (relevant sites are presented in Table 4-2).

Table 4-2
Ecological Receptor Locations

Site	Designation	Within Screening Criteria Distance of	Approximate Distance / Direction from the Site	Most Sensitive Habitat
Howe Wood	AW	Site 1	240m / NE	Broadleaved, Mixed and Yew Woodland
Markhams Wood	AW	Site 1	560m / S	Broadleaved, Mixed and Yew Woodland
Hare Wood	AW	Site 1	1,550m / NE	Broadleaved, Mixed and Yew Woodland
Over and Lawn Woods	SSSI and AW	Site 1 and Site 2	1,030 / N (Site 1) 760m / SE (Site 2)	Broadleaved, Mixed and Yew Woodland
Littley Wood	AW	Site 1 and Site 2	1,780m / NE (Site 1) 760m / SE	Broadleaved, Mixed and Yew Woodland
Cadge's Wood	AW	Site 2	20m / S and SW	Broadleaved, Mixed and Yew Woodland
North Wood	AW	Site 2	380m / E	Broadleaved, Mixed and Yew Woodland
New Plantation	AW	Site 2	670m / ENE	Broadleaved, Mixed and Yew Woodland
Leys Wood	AW	Site 2	1,250, WSW	Broadleaved, Mixed and Yew Woodland

[19] Natural England, www.magic.gov.uk, accessed November 2022.
[20] Natural England, https://naturalengland-defra.opendata.arcgis.com, accessed November 2022

4.2 Ambient Air Quality

Monitoring data collected prior to the COVID-19 pandemic (i.e. pre-2020) has been used to characterise the baseline environment, as pollutant concentrations monitored during 2020 and 2021 are expected to be atypical, and not representative of the local environment. This approach is in line with the IAQM position statement, which recommends the following:

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

The latest publicly available Annual Status Report (ASR) for WSC at the time of writing is the 2021 ASR[21] and therefore the data presented for 2020 were potentially impacted by the COVID-19 pandemic. As such, the 2020 data have not been presented and has been discounted from further consideration.

4.2.1 Local Air Quality Management

A review of the 2021 ASR indicates that air quality, in regard to NO_2 concentrations, is generally good across the WSC administrative areas. No exceedances of the current Air Quality Objectives have been identified across the administrative area.

WSC have declared three AQMAs for exceedences of the annual mean NO_2 objective; the Newmarket AQMA, Great Barton and Sicklesmere Road AQMA and the Bury St Edmunds AQMA. These are located at a distance of 15km or more from the Proposed Development. Therefore, these AQMAs have not been considered further within this study.

4.2.2 Passive Diffusion Tube Monitoring

Passive diffusion tube monitoring is currently undertaken by WSC at numerous locations throughout the Council's administrative area as part of their commitment to LAQM. The diffusion tubes are located in areas which are deemed to require further assessment of NO_2 concentrations. The majority of the monitoring locations are located within the urban areas, including Newmarket and Bury St Edmunds Town Centres (within the corresponding AQMAs), and are therefore not representative of the site locale, which is rural.

A small number of monitoring locations are located within Haverhill Town Centre, approximately 2.5km to the east of the Proposed Development at the closest point. The monitored NO_2 concentrations at these monitoring locations are presented in Table 4-3 below.

[21] 2021 Air Quality Annual Status Report (ASR), West Suffolk Council, July 2021.

Table 4-3
NO_2 Diffusion Tube Monitoring Results

Monitoring Location	Site Classification	Approximate Distance / Direction from the Site	Annual Mean Concentration (µg/m³)	
			2018	2019
HH1	Suburban (A)	4.3km / east	12.3	12.1
HH2	Roadside (B)	2.9km / east	28.8	28.5
HH3	Roadside (B)	2.5km / east	33.8	31.2
HH5	Roadside (B)	2.5km / east	33.1	30.0

Notes:
(A) A location type situated in a residential area on the outskirts of a town or city.
(B) A site sampling typically within one to five metres of the kerb of a busy road (although distance can be up to 15 m from the kerb in some cases).

As presented in Table 4-3 above, recorded annual mean NO_2 concentrations are below the annual mean NO_2 AQAL, and have decreased between 2018 and 2019.

4.2.3 Automatic Air Quality Monitoring

WSC operate a number of automatic monitoring stations, however all of these monitoring stations are located within an AQMA and are therefore not considered representative of the Site locale.

NO_2 and SO_2 concentrations are monitored nationally through the 'Automatic Urban and Rural Network' (AURN) and the 'Acid Gas and Aerosol Network'. These networks are used to quantify temporal and spatial changes in concentrations of these pollutants on a long-term basis.

The closest AURN monitoring stations are 'Cambridge' and 'Wicken Fen', located approximately 22km northwest and 24km north of the Site respectively. The Cambridge monitor is set within an 'Urban Traffic' monitoring location, and is therefore not considered representative of the Site locale and has not been considered further. The Wicken Fen monitoring station is also part of the Acid Gas and Aerosol Network and monitors SO_2 concentrations.

The monitored NO_2 concentrations are presented in Table 4-4 and SO_2 concentrations in Table 4-5. The recorded NO_2 and SO_2 concentrations are below the relevant AQALs.

Table 4-4
Automatic NO_2 Monitoring Results

Monitoring Station	Monitoring Period	Site Classification	Annual Mean NO_2 Concentration (µg/m³)	Number of Hours >200µg/m³	Data Capture (%)
Wicken Fen (UKA00362)	01/01/2019 to 31/12/2019	Rural background	8.5	0	93.8

Table 4-5
Automatic SO_2 Monitoring Results

Monitoring Station	Monitoring Period	Average Annual SO_2 Concentration (µg/m^3)	Number of 15-minute Means >266µg/m^3	Number of 1-hour Means >350µg/m^3	Number of 24-hour Means >125µg/m^3	Data Capture (%)
Wicken Fen (UKA00362)	01/01/2019 to 31/12/2019	0.94	0	0	0	68.3

4.2.4 Defra Modelled Background Concentrations and Projections

Predictions of background pollutant concentrations on a 1km-by-1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality[22]. The maximum mapped background concentrations of NO_2, PM_{10} and $PM_{2.5}$ in the Site locale, based upon the 2018 base year Defra update and projected to 2022, were downloaded for the grid squares containing the Sites and relevant receptors, as presented within Table 4-6.

Table 4-6
Background Concentrations for Study Area

Pollutant	2022 Mapped Background Concentration (µg/m^3)
NO_2	7.9
PM_{10}	16.4
$PM_{2.5}$	9.3

The Defra background predictions indicate annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are below the relevant AQALs across the study area.

4.2.5 Monitoring of Other Pollutants

Ammonia is not monitored as part of the LAQM regime and therefore does not form part of the monitoring undertaken by WSC.

Ammonia is however monitored nationally through the '*National Ammonia Monitoring Network*'. This network is used to quantify temporal and spatial changes in concentrations of NH_3 on a long-term basis. The monitoring results from the closest monitoring site within the National Ammonia Monitoring Network is presented in Table 4-7.

[22] Background mapping data for local authorities – http://uk-air.defra.gov.uk/data/laqm-background-home, accessed November 2022.

Table 4-7
Automatic NH_3 Monitoring Results

Monitoring Station	Monitoring Period	Site Classification	2020 Annual Mean NH_3 Concentration (µg/m^3)
Stanford 2 [(A)] (UKA00476)	01/01/2020 to 31/12/2020	Rural background	2.15
Table note: (A) 2020 data presented, as data for 2021 was incomplete (approximately 50% data capture).			

4.3 Baseline Conditions at Human Receptors

The background concentrations in Table 4-8 have been applied in this Air Quality Assessment. In general, a conservative approach has been applied with use of the higher background concentrations as a worst-case scenario.

Table 4-8
Applied Background Concentrations

Pollutant	Averaging Period	Concentration (µg/m^3)	Data Source
NO_2	Annual Mean	8.5	2019 annual mean concentration monitored at the Wicken Fen monitoring station
	1-hour Mean	17.0	2 x the above, following the H1 guidance note
NH_3	Annual Mean	2.15	2020 annual mean concentration monitored at the Stanford 2 monitoring station
	1-hour Mean	4.30	2 x the above, following the H1 guidance note

4.4 Baseline Conditions at Ecological Receptors

The Air Pollution Information System (APIS) website[23] is a support tool used in the assessment of potential effects of air pollutants upon habitats and species - developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology. The APIS support tool has subsequently been used to provide information on background pollutant concentrations, current deposition rates and C_{Lo}'s for nutrient nitrogen (Table 4-9) and C_{Lo} functions for acidity (Table 4-10).

[23] http://www.apis.ac.uk/, accessed January 2023.

Table 4-9
Critical Levels and Current Loads

Site	APIS Critical Load Class (most sensitive)	NO_x Annual Mean (µg/m^3)	SO_2 Annual Mean (µg/m^3)	NH_3 Annual Mean (µg/m^3)	Critical Load Range (kg N/ha/yr)	Critical Load Applied in Assessment (kg N/ha/yr)	Current Load (kg N/ha/yr)
Howe Wood (AW) (A)	Broad-leaved, mixed and yew woodland	9.1	0.68	1.97	10-20	10	32.8
Markhams Wood (AW) (B)	Broad-leaved, mixed and yew woodland	9.7	0.73	1.97	10-20	10	32.8
Hare Wood (AW) (C)	Broad-leaved, mixed and yew woodland	9.1	0.75	1.97	10-20	10	32.8
Over and Lawn Woods (SSSI, AW)	Broad-leaved, mixed and yew woodland	8.9	0.73	1.97	15-20	15	32.8
Littley Wood (AW) (D)	Broad-leaved, mixed and yew woodland	8.9	0.66	1.97	10-20	10	32.8
Cadge's Wood (AW) (E)	Broad-leaved, mixed and yew woodland	8.9	0.75	1.97	10-20	10	32.8
North Wood (AW) (F)	Broad-leaved, mixed and yew woodland	8.8	0.75	1.97	10-20	10	32.8
New Plantation (AW) (G)	Broad-leaved, mixed and yew woodland	8.9	0.75	1.97	10-20	10	32.8
Leys Wood (AW) (H)	Broad-leaved, mixed and yew woodland	9.0	0.75	1.97	10-20	10	32.8

Table note:
Defined by APIS for the following grid references: (A) x564761, y247077, (B) x564023, y246200, (C) x562402, y247663, (D) x564945, y248610, (E) x563990, y249376, (F) x564900, y249530, (G) x565070, y249920 and (H) x562730, y249140.

Table 4-10
Acid Critical Load Functions and Current Loads

Site	APIS Critical Load Class (most sensitive)	Critical Load Function (k_{eq}/ha/yr)			Current Load (k_{eq}/ha/yr)	
		CLmaxS	CLminN	CLmaxN	N	S
Markhams Wood (AW) [(A)]	Broad-leaved, mixed and yew woodland	10.786	0.214	11.000	2.45	0.15
Howe Wood (AW) [(B)]	Broad-leaved, mixed and yew woodland	10.786	0.214	11.000	2.45	0.15
Hare Wood (AW) [(C)]	Broad-leaved, mixed and yew woodland	10.790	0.214	11.004	2.45	0.15
Over and Lawn Woods (SSSI / AW)	Broad-leaved, mixed and yew woodland	10.792	0.214	11.006	2.4	0.2
Littley Wood (AW) [(D)]	Broad-leaved, mixed and yew woodland	10.787	0.214	11.001	2.45	0.15
Cadge's Wood (AW) [(E)]	Broad-leaved, mixed and yew woodland	10.789	0.214	11.003	2.45	0.15
North Wood (AW) [(F)]	Broad-leaved, mixed and yew woodland	10.789	0.214	11.003	2.45	0.15
New Plantation (AW) [(G)]	Broad-leaved, mixed and yew woodland	10.806	0.214	11.020	2.42	0.17
Leys Wood (AW) [(H)]	Broad-leaved, mixed and yew woodland	10.791	0.214	11.005	2.45	0.15

Table note:
Defined by APIS for the following grid references: (A) x564023, y246200, (B) x564761, y247077, (C) x562402, y247663, (D) x564945, y248610, (E) x563990, y249376, (F) x564900, y249530, (G) x565070, y249920 and (H) x562730, y249140.

4.5 Meteorological Conditions

The most important climatic parameters governing the release and dispersal of fugitive emissions from the Site are:

- wind direction which determines the broad direction of dispersal; and
- wind speed will affect ground level emissions by increasing the initial dilution of pollutants in the emission.

The nearest meteorological recording station to the Proposed Development is the Cambridge meteorological recording station, located approximately 19km to the northwest. However in consideration of the surrounding land use (urban) and elevation of the Cambridge meteorological recording station (15m) in comparison to the Proposed Development (85-100m elevation, rural area), this station was not considered representative of the Site locale.

The Andrewsfield meteorological recording station is the next closest to the Proposed Development (located 24km to the south), located in a setting more similar to that of the Proposed Development (80m elevation, rural). A windrose from the Andrewsfield meteorological recording station, showing the frequency of wind speed and direction, used in the assessment is provided in Figure 4-5 below. The windrose shows winds from the south-west are most prevalent.

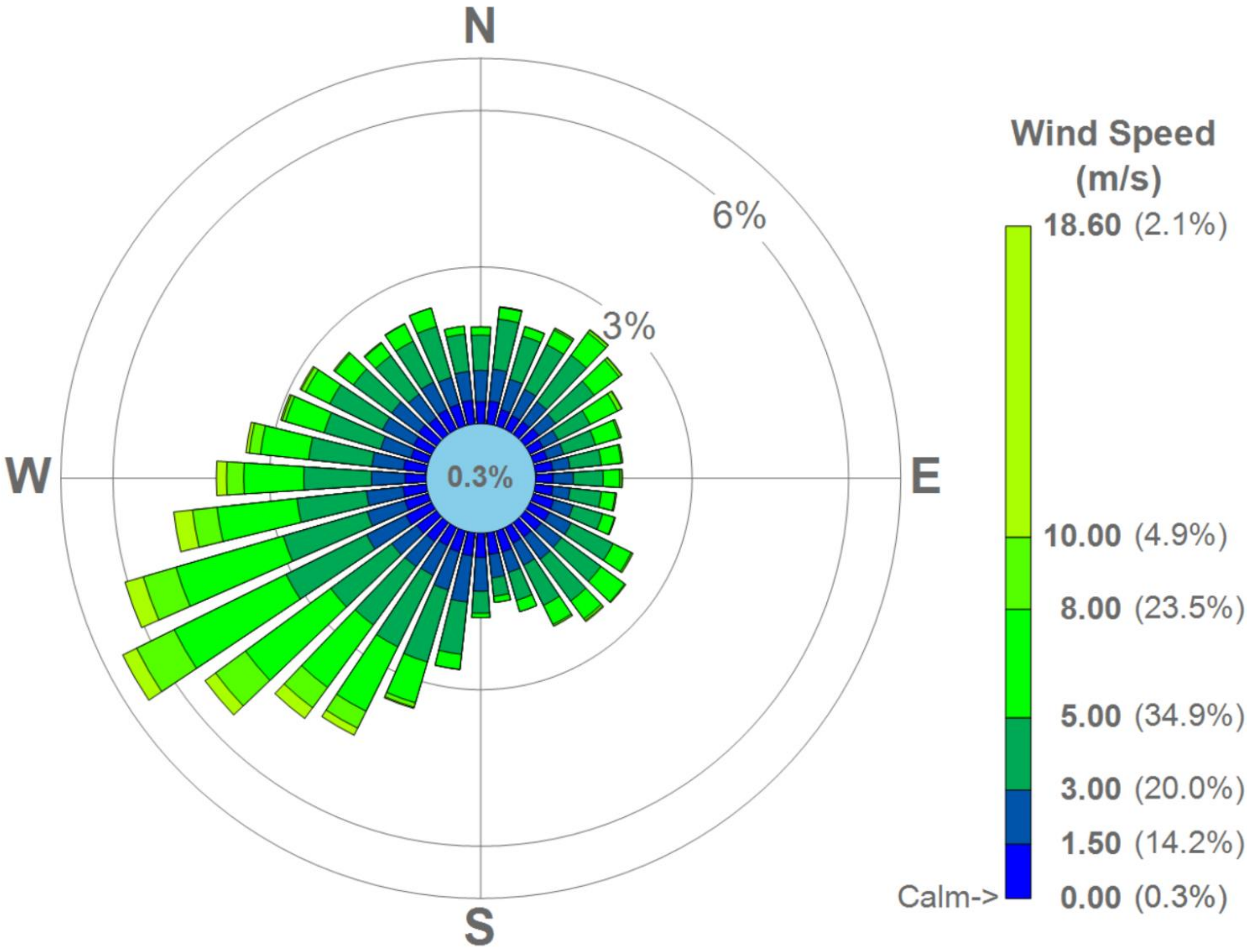


Figure 4-5
Andrewsfield Recording Station Windrose (2017 - 2021 average)

One of the most important meteorological factors to consider when undertaking an assessment of odour, bioaerosols or dust is low wind speeds (winds below 5m/s). During periods of low wind speeds, the dispersion of airborne particles/odours is much less effective. Low wind speeds (below 5m/s) are relatively frequent at approximately 35% of hours in an 'average' year. Moderate to high winds (above 5m/s) occur for the remaining hours (approximately 65%) in an 'average' year, predominantly from the southwest.

Rainfall is also an important climatological parameter supressing the generation of dust. Rainfall greater than 0.2mm per day is considered sufficient to suppress dust emissions.

Relevant rainfall data applicable to the site has been obtained from the Meteorological Office website[24]. Utilising the map of climate averages from the met office, the number of days with rainfall greater than 0.2mm is between 170 and 180 days per year (~48%).

4.6 Existing Emissions Sources

4.6.1 Existing Sources of Odour, Dust and Ammonia

A review of baseline conditions with respect to odours in the surrounding area has been undertaken by reviewing aerial imagery. Through review of aerial imagery the only significant sources of odours, dust and ammonia identified is the existing agricultural activity in the area (i.e. working of agricultural land). However, in consideration of the likely infrequent nature of these activities, this potential source has not been considered further within this assessment.

4.6.2 Bioaerosols

Offsite activities and the local environments can affect localised concentrations of bioaerosols in ambient air.

Therefore it should be considered that the nearby agricultural and wooded areas can represent a significant potential source of bioaerosols.

[24] Meteorological Office, UK Climate Averages https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcjs3tzpf. Accessed November 2022.

5.0 CONSTRUCTION PHASE ASSESSMENT

5.1 Construction Dust Assessment

Where figures are presented relating to area of the Site, volume of the Site, approximate number of construction vehicles or distances to receptors are given, these relate to thresholds as defined in the IAQM guidance to guide the assessor to define the dust emissions magnitude and sensitivity of the area.

5.1.1 Site 1

As presented in Figure 5-1 below, there are human receptors within 350m to the southeast and southwest of Site 1. There are no sensitive ecological sites within 50m of the boundary, or within 50m of the route used by construction vehicles on the public highway up to 200 m from the site entrance(s). As such, an assessment considering only human receptors is required (no assessment of ecological receptors is required).

As there are no human receptors situated within 50m of the route used by construction vehicles on the public highway up to 200 m from the site entrance(s), an assessment of potential trackout effects has been screened out.

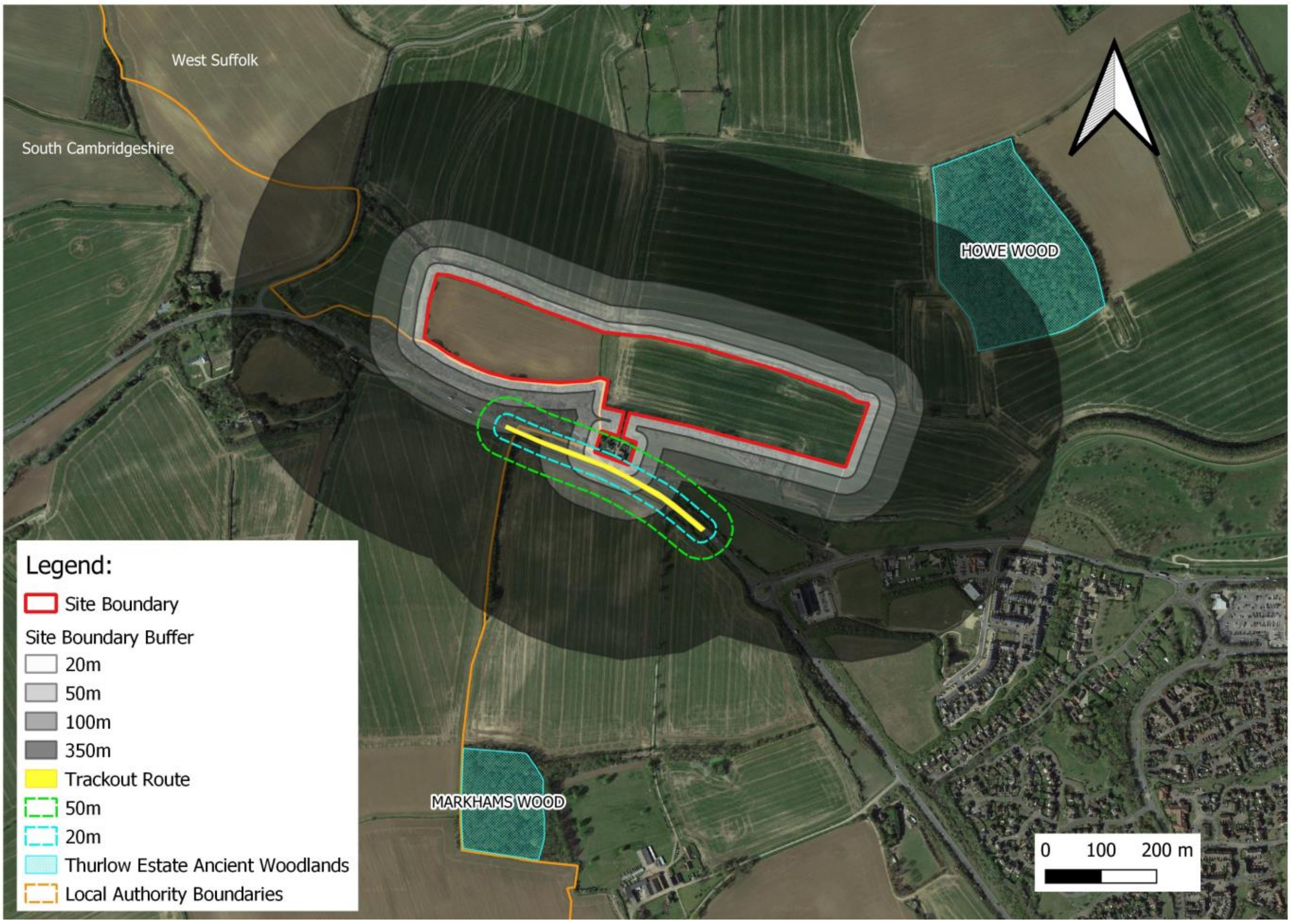


Figure 5-1
Construction Dust Screening Distances – Site 1

Potential Dust Emissions Magnitude

The potential dust emission magnitude for each activity has been assessed and assigned on the basis of the criteria presented in the IAQM guidance and is presented in Table 5-1.

Table 5-1
Site 1 - Potential Dust Emission Magnitude

Activity	Considerations	Dust Emission Magnitude
Demolition	Site 1 primarily comprises undeveloped agricultural land, as well as Spring Grove Farm (located at the southern edge of the site adjacent to the site entrance). It is proposed that some or all of these buildings may be removed prior to the construction phase. The volume of material removed will be <20,000m^3. Therefore, the overall dust emission id considered to be 'small'.	Small
Earthworks	Site earthworks are required over an area of approximately 11.5 hectares (115,000m^2). This constitutes a 'large' dust emission magnitude in accordance with the IAQM criterion (area greater than 10,000m^2). Due to the scale of the proposed plans and the size of the Site, it has been assumed that 10 or more heavy earth moving vehicles may be active at any one time.	Large
Construction	The total building volume is predicted to be between 25,000m^3 and 100,000m^3. This constitutes a 'medium' dust emission magnitude in accordance with the IAQM criterion. Construction materials are likely to comprise concrete bases with structure of steel framework and cladding. There is the potential for concrete batching to be undertaken on Site over the construction period, therefore the overall dust emissions magnitude is considered 'medium'.	Medium
Trackout	Given the scale and nature of works required, there are anticipated to be between 10 and 50 Heavy Duty Vehicle (HDV) outward movements in any worst-case day. Given the size of the Site, the worst-case unpaved road length is anticipated be between 50 and 100m at any given time.	Medium

Sensitivity of the Area

Dust Soiling Impacts

The Site surroundings comprise agricultural/cultivated land, with isolated dwellings, commercial space and woodland further afield. There are no high sensitivity receptors located within 50m of the Site or within 20m of the access routes 200m from the entrance of Site 1. The nearest sensitive receptor, a commercial premises (The Epicentre, denoted by H10), located at a distance of approximately 230m southeast of the Proposed Development.

The sensitivity of the area with respect to dust soiling effects on people and property in relation to demolition, earthworks and construction is therefore considered to be 'low'.

Human Health Impacts

The existing air quality, in terms of annual PM_{10}, has been taken from the 2022 Defra background maps to represent conditions at the Site. The maximum background PM_{10} concentration for the grid squares including and surrounding Site 1 is 16.4 µg/m^3 (i.e. falls into the <24µg/m^3 class). Moreover, concentrations are predicted to decrease year on year.

Given the above information regarding the number of residential receptors in proximity of Site 1, the sensitivity of the area with respect to human health impacts in relation to earthworks, construction and trackout is therefore considered to be 'low'.

Summary

A summary of the sensitivity of the area for each potential impact and activity is presented in Table 5-2.

Table 5-2
Site 1 - Sensitivity of the Area

Potential Impact	Sensitivity of Surrounding Area		
	Demolition	Earthworks	Construction
Dust Soiling	Low	Low	Low
Human Health	Low	Low	Low

Risk of Impacts

The outcome of the assessment of the potential ‘magnitude of dust emissions’, and the ‘sensitivity of the area’ are combined in Table 5-3 below to determine the risk of impact which is used to inform the selection of appropriate mitigation.

Table 5-3
Site 1 - Risk of Dust Impacts (without mitigation)

Potential Impact	Demolition	Earthworks	Construction
Dust Soiling	Negligible Risk	Low Risk	Low Risk
Human Health	Negligible Risk	Low Risk	Low Risk

Following the construction dust assessment, Site 1 is predicted to comprise a ‘low’ risk in relation to dust soiling and human health effects at nearby sensitive receptors. Furthermore, any potential dust effects during the construction phase would be temporary in nature and may only arise at particular times (i.e. certain activities and/or meteorological conditions).

Mitigation Measures

The specific mitigation measures proposed are presented in Section 7.

5.1.2 Site 2

As presented in Figure 5-2 below, there are no human receptors within 350m of Site 2. There is a sensitive ecological site (Cadge’s Wood) within 50m of the boundary and within 50m of the route used by construction vehicles on the public highway up to 200 m from the site entrance. As such, an assessment considering only ecological receptors is required (no assessment of human receptors is required).

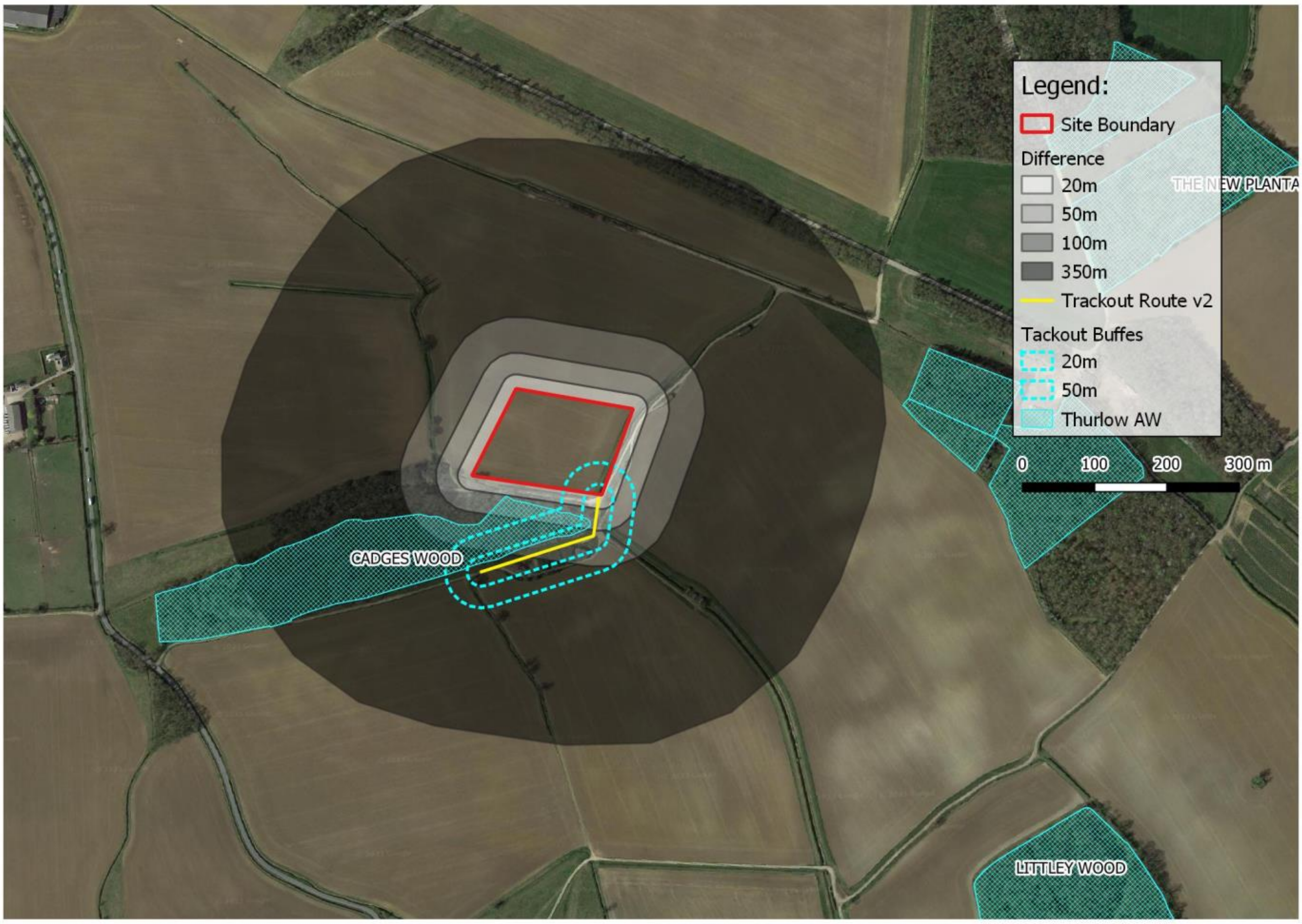


Figure 5-2
Construction Dust Screening Distances – Site 2

Potential Dust Emissions Magnitude

The potential dust emission magnitude for each activity has been assessed and assigned on the basis of the criteria presented in the IAQM guidance and is presented in Table 5-14.

Table 5-4
Site 2 - Potential Dust Emission Magnitude

Activity	Considerations	Dust Emission Magnitude
Demolition	Site 2 primarily comprises undeveloped agricultural land. As such, no demolition activities are proposed in the construction of the Proposed Development.	n/a
Earthworks	Site earthworks are required over an area of approximately 2 hectares (20,000m^2). This constitutes a ‘large’ dust emission magnitude in accordance with the IAQM criterion (area greater than 10,000m^2). Due to the scale of the proposed plans and the size of the Site, it has been assumed that 10 or more heavy earth moving vehicles may be active at any one time.	Large

Activity	Considerations	Dust Emission Magnitude
Construction	The total building volume is predicted to be less than 25,000m^3. This constitutes a 'small' dust emission magnitude in accordance with the IAQM criterion. Construction materials are likely to comprise concrete bases with structure of steel framework and cladding. The overall dust emissions magnitude is considered 'small'.	Small
Trackout	Given the scale and nature of works required, there are anticipated to be between 10 and 50 Heavy Duty Vehicle (HDV) outward movements in any worst-case day. Given the size of the Site, the worst-case unpaved road length is anticipated be between 50 and 100m at any given time.	Medium

Sensitivity of the Area

Dust Soiling Impacts

The Site surroundings comprise agricultural/cultivated land, with the Cadge's Wood AW to the south and southwest.

The sensitivity of the area with respect to ecological receptors in relation to demolition, earthworks and construction is therefore considered to be 'low'.

Summary

A summary of the sensitivity of the area for each potential impact and activity is presented in Table 5-5.

Table 5-5
Site 2 - Sensitivity of the Area

Potential Impact	Sensitivity of Surrounding Area		
	Earthworks	Construction	Trackout
Ecological	Low	Low	Low

Risk of Impacts

The outcome of the assessment of the potential 'magnitude of dust emissions', and the 'sensitivity of the area' are combined in Table 5-6 below to determine the risk of impact which is used to inform the selection of appropriate mitigation.

Table 5-6
Site 2 - Risk of Dust Impacts (without mitigation)

Potential Impact	Earthworks	Construction	Trackout
Ecological	Low Risk	Negligible Risk	Low Risk

Following the construction dust assessment, Site 2 is predicted to comprise a 'low' or 'negligible' risk in relation to dust effects at nearby sensitive ecological receptors. Furthermore, any potential dust effects during the construction phase would be temporary in nature and may only arise at particular times (i.e. certain activities and/or meteorological conditions).

Mitigation Measures

The specific mitigation measures proposed are presented in Section 7.

5.2 Construction Traffic Screening

5.2.1 Trip Generation

The construction phase of the Proposed Development would result in a temporary increase in road traffic arriving at and leaving the Site, and as such a screening assessment of the associated trip generation is required.

Construction of the Proposed Development would result in the temporary employment of contractors at the Site. The associated increase in LDVs (from contractors commuting to work) has been considered through adoption of a suitably conservative assessment approach; assuming that all contractors travel to the Site via car (without carpooling) every day.

In consideration of the size and nature of the construction operations, the anticipated number of LDVs movements to/from the Site each day (i.e. construction staff commuting and small deliveries) is anticipated to be fewer than 250, as AADT.

The construction of the Proposed Development would result in import and exports of goods and materials to/from the Site via road. In consideration of the size and nature of the construction operations, the anticipated number of HDVs movements to/from the Site each day is anticipated to be 16, as AADT (equating to approximately 6,000 movements per year).

5.2.2 Screening Assessment – Consideration of Potential Impacts

The Proposed Development is not located within or in proximity to any AQMAs, therefore the appropriate screening criteria have been applied.

Based upon the anticipated trip generation details outlined above, the predicted number of additional journeys (less than 100 HDVs and 500 LDVs as AADT) are below the relevant criteria for a site situated outside an AQMA.

Therefore, in accordance with the EPUK & IAQM Guidance, the *'impacts* [on air quality from construction phase trips] *can be considered as having an insignificant effect*'.

6.0 OPERATIONAL PHASE ASSESSMENT

6.1 Process Description

The total feedstock for the development is anticipated to be 92,000 tonnes/year consisting of mostly straw and silage (rye, maise, oat and grass), comprising approximately 70% of the total, with the remainder comprising poultry litter and farmyard manure (FYM) (remaining 30%).

Feedstocks would arrive by road via tractors or lorries with open trailers. Poultry litter and FYM would be received within enclosed trailers.

Silage feedstocks would be stored within the designated outdoor area (Clamps 1, 2 and 3), a concrete hardstanding area with retaining walls, and covered by weighed-down sheeting (comprising an oxygen barrier and bird netting). Straw would be stored within the Straw Bunker, a partially enclosed barn on hard-standing surface, providing protection from the weather.

Poultry litter and FYM would be stored within the Manure Shed. The Manure Shed would be enclosed, with air extracted and treated by a dedicated abatement system. The Liquid Digestate Storage Tank would be enclosed with passive ventilation.

Feedstock handling operations would comprise the movement of silage from the clamps, straw from the Straw Bunker and poultry litter and FYM from the Manure Shed. The handling operations would be undertaken by a front-end loader (or similar such vehicle). Feedstock would be deposited within the hoppers periodically to load the digesters with new feedstock as required.

Leachate from Clamps 1 ,2 and 3 would be pumped to the leachate/digestate storage tank. The tank would be enclosed and fitted with passive ventilation (grating/louvre). The leachate would be diluted with rainwater runoff from the hardstanding clamp areas. A much smaller comparative volume of digestate liquors from the separation process (as detailed further below) would be collected in the same tank.

Following anaerobic digestion, the solids and liquids within the digestate would be separated, removing most of the liquid from the digestate. The liquid fraction (liquid digestate) would be pumped to the lagoons and the solid fraction (solid digestate) stored within the Separator building pending export. The Separator would be located within an enclosed building with passive ventilation (the Separator Building).

Liquid digestate would be stored within five covered lagoons; three located on Site 1 (total capacity of 30,000m^3), and two located on Site 2 (total capacity of 22,500m^3).

A pipeline would connect Site 1 and Site 2, facilitating the transfer of liquid digestate between the Sites. It should be noted that the pipeline has been assessed in isolation within a separate AQA[25].

Road tankers will remove liquid digestate from the lagoons (at both Site 1 and Site 2) through use of a vacuum pumping system.

The solid digestate (fertiliser) produced by the Separator would be stored within a dedicated bay within the Separator building prior to export offsite. It is anticipated that solid digestate would only be stored at the Site for short periods, pending regular collections for off-site export.

Generation of heat and power for the proposed operations would be provided by two CHP engines.

[25] SLR report: "404.V11923.00004_Pipeline_AQA"

6.2 Odour Assessment

6.2.1 Site 1

Source Odour Potential

The potential odour sources on Site 1 are described in Table 6-1.

Table 6-1
Site 1 - Potential Sources of Odours

Source	Considerations	Potential
Feedstock import	Import operations (road trucks/tractors with trailers) are transient in nature and containment is provided for liquid feedstocks. Feedstock types with a higher odour potential (poultry litter and FYM) would be offloaded within the enclosed (passive ventilation) Manure Shed.	Small
Feedstock storage	Silage feedstocks are stored within Clamp 1, 2 and 3, covered by weighed-down sheeting (comprising an oxygen barrier). Straw is stored within the Straw Bunker, a partially enclosed barn on hard-standing surface, providing protection from the weather. Poultry litter and FYM would be stored within the Manure Shed, which would be enclosed, with air extracted and treated by a dedicated abatement system. The abatement system would reduce the odour concentration of air extracted from the Manure Shed prior to release to atmosphere.	Small
Feedstock handling	The majority of the feedstock types handled have a low odour potential (poultry litter and FYM comprises a lesser fraction) and the handling events (import and loading of the feed hoppers) would be transient in nature.	Small
Leachate / liquor storage	Leachate from the silage clamps (diluted with rainwater runoff from the hardstanding clamp areas) would be stored within a dedicated tank. Digestate liquors from Separator would also be stored within the tank, but in comparatively low volumes compared to the runoff. The tank would be enclosed and fitted with passive ventilation (grating/louvre).	Small
Anaerobic digestion	The gas capture system would effectively contain potential odours from the anaerobic digestion process, for subsequent processing into biogas.	Negligible
Liquid digestate	The digestate would be stored within the three covered lagoons located on Site 1. Having been through the anaerobic digestion process, the material would have low microbial activity and therefore a low associated odour potential. However, the large surface area of the covered lagoons has also been considered.	Medium
Liquid digestate export	Road tankers would remove liquid digestate from Site 1 through use of a vacuum pumping system. Air displaced from within the tankers would be released to atmosphere, resulting in a limited volume of potentially odorous air being released from these transient activities.	Small

Source	Considerations	Potential
Production of solid digestate	From observations at other existing sites applying this process[26], the odour emissions from the separation process are anticipated to be low. The Separator would be located within an enclosed building with passive ventilation (the Separator Building).	Small
Solid digestate storage and export	Solid digestate (fertiliser) produced by the Separator would be stored within a dedicated bay within the Separator building. Solid digestate is anticipated to have a low odour potential, given the low microbial activity of the product (post anaerobic digestion) and the low water content (following processing by the Separator). Export operations would comprise loading of trailers within the Separator building, providing a level of containment to emissions resulting from agitation.	Small

Existing Sources of Odours

As outlined in Section 4.6.1, there are no significant existing sources of odour in the site locale. Site 2 is located approximately 2.5km to the north of Site 1, and as such none of the sensitive receptors identified in proximity to Site 1 are likely to experience odours from Site 2, in consideration of the extended separation distance.

Overall Source Odour Potential

In review of the above, adopting a suitably cautious approach, the source odour potential of Site 1 is 'medium'.

Pathway Effectiveness

The pathway effectiveness to the sensitive receptors was determined through a combination of the distance to the emission source, the frequency of winds with the potential to disperse odour towards that receptor and the effectiveness of dispersion/dilution of odours from the sources identified at Site 1. The determination of pathway effectiveness is presented in Table 6-2. The effectiveness of dispersion/dilution of odours from the sources identified at Site 1 is low, reflecting open processes with low-level releases.

Table 6-2
Site 1- Determination of Pathway Effectiveness

Receptor		Direction from Proposed Development Boundary	Distance from Proposed Development Boundary (m)	Pathway Effectiveness
H 1	Silver Street	N	620	Ineffective
H 2	Horseheath Rd	N	830	Ineffective
H 3	Homestall Crescent	NE	830	Ineffective
H 4	Queen Street	E	940	Ineffective
H 5	Three Counties Way	SE	320	Ineffective
H 6	Darwin Walk	SE	410	Ineffective
H 7	Darwin Walk	SE	460	Ineffective
H 8	Hanchett End	SSE	550	Ineffective
H 9	The Flying Shuttle	SE	240	Ineffective

[26] At other anaerobic digestion sites and at sewage treatment works, where the same technology is applied to produce a solid product.

Receptor		Direction from Proposed Development Boundary	Distance from Proposed Development Boundary (m)	Pathway Effectiveness
H 10	The Epicentre Haverhill	SE	210	Ineffective
H 11	Hatchet Hall Cattery and Kennels	S	690	Ineffective
H 12	Off A1307	SW	320	Ineffective
H 13	Off A1307	WSW	390	Ineffective
H 14	Off A1307	W	400	Ineffective

Likely Magnitude of Odour Effect

The likely magnitude of odour effect has been determined by consideration of the source odour potential and the pathway effectiveness. The results are summarised in Table 6-3.

Table 6-3
Site 1 - Determination of Likely Odour Effect

Receptor		Source Odour Potential	Pathway Effectiveness	Odour Exposure Risk	Receptor Sensitivity	Likely Odour Effect
H 1	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 2	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 3	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 4	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 5	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 6	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 7	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 8	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 9	Commercial	Medium	Ineffective	Negligible	Medium	Negligible effect
H 10	Commercial	Medium	Ineffective	Negligible	Medium	Negligible effect
H 11	Commercial	Medium	Ineffective	Negligible	Medium	Negligible effect
H 12	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 13	Residential	Medium	Ineffective	Negligible	High	Negligible effect
H 14	Residential	Medium	Ineffective	Negligible	High	Negligible effect

The likely odour effect is predicted to be 'negligible' at all of the considered receptors.

Therefore the likely significance of effects as a result of odours from Site 1 is considered to be 'not significant' at all identified receptor locations in accordance with the IAQM guidance.

6.2.2 Site 2

Source Odour Potential

The potential odour sources are described in Table 6-4.

Table 6-4
Site 2 - Potential Sources of Odours

Source	Considerations	Potential
Liquid digestate	Digestate would be pumped (via the pipeline) from Site 1 for storage within two covered lagoons on Site 2. Having been through the anaerobic digestion process, the material would have low microbial activity and therefore a low associated odour potential. However, the large surface area of the covered lagoon has also been considered.	Small
Liquid digestate export	Liquid digestate would be removed from Site 2 by road vehicles, through use of a vacuum pumping system. Air displaced from within tankers would be released to atmosphere, resulting in a limited volume of potentially odorous air being released from these transient activities.	Small

Existing Sources of Odours

As outlined in Section 4.6.1, there are no significant existing sources of odour in the site locale. Site 1 is located approximately 2.5km to the south of Site 2, and as such none of the sensitive receptors identified in proximity to Site 2 are likely to experience odours from Site 1, in consideration of the extended separation distance.

Overall Source Odour Potential

In review of the above, adopting a suitably cautious approach, the combined source odour potential of Site 2 is 'small'.

Pathway Effectiveness

The pathway effectiveness to the sensitive receptors was determined through a combination of the distance to the emission source, the frequency of winds with the potential to disperse odour towards that receptor and the effectiveness of dispersion/dilution of odours from the sources identified at Site 2. The determination of pathway effectiveness is presented in Table 6-5. The effectiveness of dispersion/dilution of odours from the sources identified at Site 2 is low, reflecting open processes with low-level releases.

Table 6-5
Site 2- Determination of Pathway Effectiveness

Receptor		Direction from Proposed Development Boundary	Distance from Proposed Development Boundary (m)	Pathway Effectiveness
H 15	Unnamed road	N	680	Ineffective
H 16	Skipper's Lane	S	670	Ineffective
H 17	Skipper's Lane	SSW	650	Ineffective
H 18	Skipper's Lane	W	630	Ineffective
H 19	Skipper's Lane	NW	830	Ineffective

Likely Magnitude of Odour Effect

The likely magnitude of odour effect has been determined by consideration of the source odour potential and the pathway effectiveness. The results are summarised in Table 6-6.

Table 6-6
Site 2 - Determination of Likely Odour Effect

Receptor		Source Odour Potential	Pathway Effectiveness	Odour Exposure Risk	Receptor Sensitivity	Likely Odour Effect
H 15	Residential	Medium	Ineffective	Negligible	Medium	Negligible effect
H 16	Residential	High	Ineffective	Negligible	High	Negligible effect
H 17	Residential	High	Ineffective	Negligible	High	Negligible effect
H 18	Residential	High	Ineffective	Negligible	High	Negligible effect
H 19	Residential	High	Ineffective	Negligible	High	Negligible effect

The likely odour effect is predicted to be 'negligible' at all of the considered receptors.

Therefore the likely significance of effects as a result of odours from Site 2 is considered to be 'not significant' at all identified receptor locations in accordance with the IAQM guidance.

6.3 Dust Impact Assessment

6.3.1 Site 1

Assessment of Impacts – Screening Criteria

There are human receptors with a sensitivity to dust soiling within 250m of the Site (see Section 4.1). There are no sensitive ecological receptors within 250m of the Site. Therefore, further assessment for the potential impact of deposited dust and PM_{10} on human receptors is required.

Dust Soiling Potential

The potential dust sources are described in Table 6-7.

Table 6-7
Site 1 - Potential Sources of Dust

Source	Considerations	Potential
Feedstock import	Silage offloaded within the clamps. Straw offloaded within partially enclosed structure (Straw Bunker). Poultry Litter and FYM offloaded within an enclosed structure (Manure Shed). Import operations would be transient in nature.	Small
Feedstock storage	Silage feedstocks are stored within Clamps 1, 2 and 3, covered by weighed-down sheeting (comprising an oxygen barrier). Clamps 1, 2 and 3 have a hard-standing surface and retaining walls. Straw is stored within the Straw Bunker, a partially enclosed barn on hard-standing surface, providing protection from the weather. Poultry litter and FYM would be stored within the Manure Shed, which would be enclosed with air extracted and treated by a dedicated abatement system. The abatement system.	Small

Source	Considerations	Potential
Feedstock handling	Operations would comprise the movement of silage from the clamps, straw from the straw barn and poultry litter and FYM from the Manure Shed to the feed hopper. The handling operations would be undertaken by heavy plant, anticipated to be a front-end loader. Handling operations would be transient in nature.	Small
Vehicle Movements	Movement of vehicles across the hardstanding traffic routes at the Site, associated with import/export operations (lorries or tractors with trailers) and handling operations (front-end loader). Vehicle movements would be transient in nature.	Small
Solid digestate storage and export	Solid digestate (fertiliser) produced by the Separator would be stored within a dedicated bay within the Separator building. Export operations would comprise loading of trailers (within the Separator building), providing a level of containment to emissions resulting from agitation.	Small

Existing Sources of Dust

As outlined in Section 4.6.1, there are no significant existing sources of dust in the site locale.

Overall Residual Source Emission

In consideration of the above, the overall residual source emission is considered 'small'.

Likely Magnitude of Dust Risk

The likely magnitude of dust effects has been determined by consideration of the residual source emission and the pathway effectiveness. The results are summarised in Table 6-8 and Table 6-9 below.

Table 6-8
Site 1 - Determination of Pathway Effectiveness

Receptor		Distance from Site 1 Boundary	Wind Sectors Affecting Receptor	Frequency of Winds <5m/s and Dry	Frequency Category	Pathway Effectiveness
H 9	The Flying Shuttle (commercial)	240m	N-W	2.0%	Infrequent	Ineffective
H 10	The Epicentre Haverhill (commercial)	210m	NNE - NW	2.4%	Infrequent	Ineffective
Table note: Sensitive receptors at a distance of more than 250m from Site 1 have not been considered.						

Table 6-9
Site 1 - Determination of Likely Dust Effects

Receptor		Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust effects
H 9	The Flying Shuttle (commercial)	Small	Ineffective	Negligible Risk	Medium	Negligible Effect

Receptor		Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust effects
H 10	The Epicentre Haverhill (commercial)	Small	Ineffective	Negligible Risk	Medium	Negligible Effect
Table note: Sensitive receptors at a distance of more than 250m from Site 1 have not been considered.						

The likely dust effect is predicted to be 'negligible' at all sensitive receptors identified.

The likely significance of effects as a result of dust generation from Site 1 is therefore considered to be 'not significant' at all identified receptor locations in accordance with the IAQM guidance.

PM_{10} Generation Potential

The existing air quality, in terms of annual PM_{10}, has been taken from the Defra background maps to represent conditions at the Site. The maximum background PM_{10} concentration for the grid square of the Site as well as surrounding receptors is 16.4 µg/m³, representing approximately 41% of the corresponding AQAL for PM_{10}. Moreover, concentrations are predicted to decrease year on year. On this basis, a significant increase in PM concentrations in the local area as a result of the operations at the Proposed Development would not be anticipated.

It is therefore considered that in the absence of designed-in or additional mitigation, the impact and effect of the Proposed Development operations on human health from emissions of PM_{10} (and $PM_{2.5}$) would be negligible.

6.3.2 Site 2

There are no significant sources of dust proposed at Site 2, as Site operations comprise the storage and export of liquid digestate only.

As such, the likely significance of effects as a result of dust generation from Site 2 can therefore be considered 'not significant'.

6.4 Traffic Screening Assessment

The sum of traffic movements from both Site 1 and Site 2 of the Proposed Development have been assessed together.

6.4.1 Trip Generation

It is anticipated that the Proposed Development would result in the following approximate daily trip generation (as AADT):

- 10 LDV movements – due to the employment of 5 staff at the Proposed Development; and
- 54 HDV movements - AADT calculated from the total anticipated number of HDVs arriving/departing based on annual tonnages processed – daily trips would fluctuate on a seasonal basis (i.e. during the harvest season when silage is brought in from the fields).

6.4.2 Screening Assessment – Consideration of Potential Impacts

Based upon the trip generation details outlined above, the predicted number of additional development trips are below the relevant criteria for a site situated outside an AQMA (as outlined in Section 3.2) for both LDVs and HDVs (500 LDVs and 100 HDVs AADT). Therefore, in accordance with the EPUK & IAQM Guidance, the *'impacts* [on air quality from operational phase trips] *can be considered as having an insignificant effect*'.

6.5 CHP Emissions Assessment

The CHP plant is located on Site 1, therefore assessment has been undertaken in consideration of Site 1 only.

6.5.1 Model Inputs

Generation of heat and power for the proposed operations would be facilitated by two CHP engines:

- CHP 1: fuelled on biogas, producing 0.6 MW_e; and
- CHP 2: fuelled on natural gas, producing 1.5 MW_e.

The modelling input parameters are detailed in Table 6-10 below. The emission parameters for the two CHPs have been determined in reference to the manufacturer's datasheet. The emission concentrations applied are compliant with EP Regulations.

Further modelling assessment details and relevant significance criteria are presented within Appendix A.

Table 6-10
Combustion Emissions Assessment: Emission Parameters

Parameter / Source	CHP1	CHP2
Electrical Output (MWe)	0.6	1.5
Fuel	Biogas	Natural gas
Stack Location (NGR x,y)	564134, 246913	564133, 246918
Stack Height (m)	7.0	7.0
Emission temperature (°C)	180 (A)	120 (A)
Stack diameter (m)	0.15	0.20
Efflux velocity (m/s)	32.4	42.6
Flow (Am^3/s)	0.57	1.34
Flow (Nm^3/s)	0.66 (B)	1.65 (C)
NO_X Concentration (mg/Nm^3)	190	95
NO_X emission (g/s)	0.12	0.16
SO_2 Concentration (mg/Nm^3)	15	-
SO_2 emission (g/s)	0.0098	-

Table note:

(A) The exhaust heat from the 2 CHP units would be utilised, reducing the design emission temperature to 120°C (for natural gas) and 180°C (for biogas).

(B) Normalised to 273K, dry, 101.3kPa, 15% O_2 assuming in-stack oxygen concentration of 8.1% (dry) and moisture content 11.9%.

(C) Normalised to 273K, dry, 101.3kPa, 15% O_2 assuming in-stack oxygen concentration of 9.0% (dry) and moisture content 11.2%.

6.5.2 CHP emissions at Human Receptors

NO_2

Predicted long-term NO_2 impacts at the modelled receptor locations are summarised in Table 6-11 and an isopleth plot is presented in Appendix A. The impact (magnitude of change) can be described as 'negligible' at all receptors identified. The AQAL is not exceeded any of the receptor locations.

Table 6-11
Predicted NO_2 Annual Mean Impacts

Receptor	Background NO_2 Concentration Applied (µg/m^3)	PC (µg/m^3)	PC as % of AQAL	PEC (µg/m^3)	PEC as % of AQAL	Impact Descriptor
H1	8.5	0.3	0.8	8.8	22.1	Negligible
H2	8.5	0.3	0.7	8.8	21.9	Negligible
H3	8.5	0.2	0.5	8.7	21.8	Negligible
H4	8.5	0.2	0.4	8.7	21.6	Negligible
H5	8.5	0.4	0.9	8.9	22.1	Negligible
H6	8.5	0.3	0.8	8.8	22.0	Negligible
H7	8.5	0.3	0.7	8.8	22.0	Negligible
H8	8.5	0.3	0.6	8.8	21.9	Negligible
H12	8.5	0.2	0.6	8.7	21.8	Negligible
H13	8.5	0.2	0.5	8.7	21.8	Negligible
H14	8.5	0.2	0.5	8.7	21.8	Negligible

Table notes:
Annual mean impacts do not apply at commercial receptors (H9, H10 and H11).
No significant sources of NO_2 emissions are identified at Site 2, therefore assessment is not required at receptors in proximity to Site 2 (H15 to H19).

Predicted short-term NO_2 impacts at the modelled receptor locations are summarised in Table 6-12, and an isopleth plot is presented in Appendix A. The impact can be described as 'small' (PC 10-20% of AQAL) at receptor R10 and 'negligible' (PC <10% of AQAL) at all other receptors identified. The AQAL is not exceeded any of the receptor locations.

Table 6-12
Predicted NO_2 1-hour Mean (99.79%ile) Impacts

Receptor	Background NO_2 Concentration Applied (µg/m^3)	PC (µg/m^3)	PC as % of AQAL	PEC (µg/m^3)	PEC as % of AQAL	Impact Descriptor
H1	17.0	9.8	4.9	26.8	13.4	Negligible

Receptor	Background NO_2 Concentration Applied ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of AQAL	PEC ($\mu g/m^3$)	PEC as % of AQAL	Impact Descriptor
H2	17.0	8.0	4.0	25.0	12.5	Negligible
H3	17.0	5.1	2.6	22.1	11.1	Negligible
H4	17.0	6.0	3.0	23.0	11.5	Negligible
H5	17.0	16.4	8.2	33.4	16.7	Negligible
H6	17.0	15.6	7.8	32.6	16.3	Negligible
H7	17.0	15.1	7.6	32.1	16.1	Negligible
H8	17.0	14.4	7.2	31.4	15.7	Negligible
H9	17.0	18.5	9.2	35.5	17.7	Negligible
H10	17.0	22.5	11.3	39.5	19.8	Small
H11	17.0	9.6	4.8	26.6	13.3	Negligible
H12	17.0	12.2	6.1	29.2	14.6	Negligible
H13	17.0	10.4	5.2	27.4	13.7	Negligible
H14	17.0	11.6	5.8	28.6	14.3	Negligible

Table notes:
No significant sources of NO_2 emissions are identified at Site 2, therefore assessment is not required at receptors in proximity to Site 2 (H15 to H19).

All impacts (short and long term) are described as either 'small' or 'negligible', therefore the effect on air quality at human receptors as a result of NO_2 emissions is considered 'not significant'.

SO_2

Predicted short-term SO_2 impacts at the modelled receptor locations are summarised in Table 6-13, 6-14 and Table 6-15 below.

Table 6-13
Predicted SO_2 15-minute Mean (99.9%ile) Impacts

Receptor	AQAL ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of AQAL	Impact Descriptor
H1	266	1.8	0.7	Negligible
H2	266	1.6	0.6	Negligible
H3	266	1.1	0.4	Negligible
H4	266	0.9	0.3	Negligible
H5	266	2.9	1.1	Negligible
H6	266	2.8	1.1	Negligible

Receptor	AQAL ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of AQAL	Impact Descriptor
H7	266	2.7	1.0	Negligible
H8	266	2.7	1.0	Negligible
H9	266	3.3	1.2	Negligible
H10	266	4.0	1.5	Negligible
H11	266	1.7	0.6	Negligible
H12	266	2.5	0.9	Negligible
H13	266	2.1	0.8	Negligible
H14	266	2.2	0.8	Negligible

Table notes:
No significant sources of SO_2 emissions are identified at Site 2, therefore assessment is not required at receptors in proximity to Site 2 (H15 to H19).

Table 6-14
Predicted SO_2 1-hour Mean (99.73%ile) Impacts

Receptor	AQAL ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of AQAL	Impact Descriptor
H1	350	0.8	0.2	Negligible
H2	350	0.6	0.2	Negligible
H3	350	0.5	0.2	Negligible
H4	350	0.5	0.1	Negligible
H5	350	1.4	0.4	Negligible
H6	350	1.4	0.4	Negligible
H7	350	1.2	0.4	Negligible
H8	350	1.2	0.3	Negligible
H9	350	1.6	0.5	Negligible
H10	350	1.9	0.6	Negligible
H11	350	0.9	0.2	Negligible
H12	350	0.9	0.3	Negligible
H13	350	0.9	0.3	Negligible
H14	350	0.9	0.3	Negligible

Table notes:
No significant sources of SO_2 emissions are identified at Site 2, therefore assessment is not required at receptors in proximity to Site 2 (H15 to H19).

Table 6-15
Predicted SO_2 24-hour Mean (99.18%ile) Impacts

Receptor	AQAL (µg/m³)	PC (µg/m³)	PC as % of AQAL	Impact Descriptor
H1	125	0.2	0.1	Negligible
H2	125	0.1	0.1	Negligible
H3	125	0.1	<0.1	Negligible
H4	125	<0.1	<0.1	Negligible
H5	125	0.2	0.2	Negligible
H6	125	0.2	0.2	Negligible
H7	125	0.2	0.2	Negligible
H8	125	0.2	0.2	Negligible
H9	125	0.3	0.3	Negligible
H10	125	0.3	0.3	Negligible
H11	125	0.1	0.1	Negligible
H12	125	0.2	0.2	Negligible
H13	125	0.2	0.1	Negligible
H14	125	0.2	0.1	Negligible

Table notes:
No significant sources of SO_2 emissions are identified at Site 2, therefore assessment is not required at receptors in proximity to Site 2 (H15 to H19).

The short-term SO_2 impacts (15-minute 99.9%ile, 1-hour 99.73%ile and 24-hour 99.18%ile) can be described as 'negligible' at all receptors identified. Therefore, the overall effect on air quality at human receptors as a result of SO_2 emissions is considered 'not significant'.

6.5.3 CHP emissions at Ecological Receptors

Assessment of critical loads and critical levels at the sensitive ecological receptors identified is presented in Section 6.8.

6.6 Bioaerosols Assessment

The Environment Agency's current position is that the requirement for assessment of bioaerosols emissions can be screened out where potential sources of bioaerosols are located at a distance of 250m or more from sensitive receptors (such as workplaces or dwellings).

In reference to Section 4.1.1 there are sensitive human receptors within 250m of the boundary of Site 1 (H9 and H10, however these receptors are located at a distance of more than 250m from the potential sources of bioaerosols at Site 1. There are no sensitive human receptors within 250m of Site 2. Therefore further consideration of bioaerosols emissions is not required.

6.7 Ammonia Impact Assessment

6.7.1 Sources of Ammonia Emissions

The potential sources of ammonia emissions from the proposed site operations comprise the following:

- poultry litter and FYM feedstocks;
- Feed Hoppers;
- liquid digestate; and
- solid digestate.

Further details on the Site process such as throughput, storage areas and containment measures are presented in Table 6-16.

Table 6-16
Ammonia Emissions Assessment: Process Details

Emission Source	Annual Throughput / Production (tonnes)	Associated Storage Area	Nature of Containment
Rye Silage	15,000	Clamp 1, 2 and 3	Covered by weighed-down sheeting (comprising an oxygen barrier and bird netting)
Maize Silage	16,500		
Oat Silage	5,000		
Grass Silage	10,000		
Wheat Straw	20,500	Straw Bunker	Partially enclosed
Poultry litter	15,000	Designated area within Manure Shed	Enclosed building with extraction and abatement
FYM	10,000		
Digestate (liquid)	60,000	Lagoons 1-5	Covered lagoons
Digestate (solid)	55,000	Designated area within the Separator Building	Enclosed building with passive ventilation

6.7.2 Model Inputs

On the basis of the process details presented above, ammonia emissions assumptions have been determined in reference to the EMEP Air Pollutant Emission Inventory Guidebook (as outlined in Section 3.7). The ammonia emissions assumptions are presented in Table 6-17 below.

Further modelling assessment details and relevant significance criteria are presented within Appendix B.

Table 6-17
Ammonia Emissions Assessment: Emission Parameters

Emission Source	Source Location	Mass of Material Stored (tonnes)	Calculated NH_3 Emission Rate (kg/year)	Reduction Applied as a Result of Containment	NH_3 Emission Rate Considering Containment (kg/year)
Manure Shed	Site1	See Table 6-18 below			
Feed Hoppers		See Table 6-19 below			
Digestate Solids		1,200 [A]	305	80% [B]	61
Digestate Lagoons 1-3		20,000 [C], [D]	2,907	95% [E]	145
Digestate Lagoons 4-5	Site 2		2,180	95% [B]	109

Table note:

(A) Defined as the maximum capacity of the storage bay within the Separator Building.
(B) Defined in reference to Ammonia Mitigation User Manual.
(C) Defined as the anticipated peak volume of liquid digestate stored over the year. This peak storage volume has then been considered year-round.
(D) It is assumed that the liquid digestate stored would be split evenly between the lagoons at Site 1 and Site 2, proportionate to storage volume (as provided in Section 6.1).
(E) Defined in reference to Ammonia emissions from UK non-agricultural sources in 2017.

Calculation of ammonia emissions from the Manure Shed has considered application of an abatement system, to which air from within the Manure Shed would be extracted to and abated prior to release to atmosphere. The emission parameters for the abatement system are presented in Table 6-18 below where the airflow rate has been determined assuming three air changes per hour from the Manure Shed and emission concentration determined in consideration of an assumed performance criteria.

Table 6-18
Ammonia Emissions Assessment: Manure Shed Abatement Unit

Parameter / Source	Manure Shed Abatement Unit
Source location	Adjacent to Manure Shed
Stack height (m)	9.0
Manure Shed building volume (m^3)	3,500
Extraction rate	three air changes per hour
Calculated extraction rate (m^3/s)	2.92
Stack diameter (m)	0.5
Efflux velocity (m/s)	14.9
Emission temperature (°C)	ambient

Parameter / Source	Manure Shed Abatement Unit
Abated air ammonia concentration (mg/m^3)	0.177 (0.25ppm)
Ammonia emissions rate from abatement unit (kg/year)	16.3
Ammonia emissions rate from abatement unit (g/s)	0.0005

The emission parameters for the feed hoppers are presented in Table 6-19 below. Calculation of ammonia emissions from the feed hoppers has considered that the hoppers would be filled with feedstocks at all times, and that approximately 30% of the feedstocks in the hoppers would be poultry and farmyard manure.

Table 6-19
Ammonia Emissions Assessment: Feed Hoppers

Parameter / Source	Feed Hoppers
Number of feed hoppers	2
Source Location	Southern edge of digestors
Release height (m)	4.8
Total volume of feed hoppers (m^3)	320
Proportion of feed hoppers containing manure	Approximately 30%
Calculated tonnage of poultry and farmyard manure within hoppers	38.4 tonnes
Reduction Applied as a Result of Containment	None
Calculated ammonia emissions rate (kg/year)	0.4

6.7.3 NH_3 emissions at Human Receptors

Predicted long-term NH_3 impacts at the modelled receptor locations are summarised in Table 6-20 and an isopleth plot is presented in Appendix B. The impact (magnitude of change) can be described as 'negligible' at all receptors identified. The AQAL is not exceeded any of the receptor locations.

Table 6-20
Predicted NH_3 Annual Mean Impacts

Receptor	Background NH_3 Concentration Applied (µg/m^3)	PC (µg/m^3)	PC as % of AQAL	PEC (µg/m^3)	PEC as % of AQAL	Impact Descriptor
H1	2.15	0.01	<0.1	2.16	1.2	Negligible
H2	2.15	0.01	<0.1	2.16	1.2	Negligible
H3	2.15	0.02	<0.1	2.17	1.2	Negligible
H4	2.15	0.01	<0.1	2.16	1.2	Negligible
H5	2.15	0.03	<0.1	2.18	1.2	Negligible
H6	2.15	0.02	<0.1	2.17	1.2	Negligible

Receptor	Background NH_3 Concentration Applied (µg/m³)	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
H7	2.15	0.02	<0.1	2.17	1.2	Negligible
H8	2.15	0.02	<0.1	2.17	1.2	Negligible
H9	2.15	0.04	<0.1	2.19	1.2	Negligible
H10	2.15	0.05	<0.1	2.20	1.2	Negligible
H11	2.15	<0.01	<0.1	2.16	1.2	Negligible
H12	2.15	0.01	<0.1	2.16	1.2	Negligible
H13	2.15	0.02	<0.1	2.17	1.2	Negligible
H14	2.15	0.01	<0.1	2.16	1.2	Negligible
H15	2.15	0.01	<0.1	2.16	1.2	Negligible
H16	2.15	0.02	<0.1	2.17	1.2	Negligible
H17	2.15	0.02	<0.1	2.17	1.2	Negligible
H18	2.15	<0.01	<0.1	2.16	1.2	Negligible
H19	2.15	<0.01	<0.1	2.16	1.2	Negligible

Predicted short-term NH_3 impacts at the modelled receptor locations are summarised in Table 6-21, and an isopleth plot is presented in Appendix B.

The impact can be described as 'negligible' (PC <10% of AQAL) at all receptors identified.

Table 6-21
Predicted NH_3 1-hour Maximum Impacts

Receptor	Background NH_3 Concentration Applied (µg/m³)	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
H1	4.30	4.20	0.2	8.50	0.3	Negligible
H2	4.30	4.45	0.2	8.75	0.4	Negligible
H3	4.30	3.21	0.1	7.51	0.3	Negligible
H4	4.30	4.00	0.2	8.30	0.3	Negligible
H5	4.30	14.82	0.6	19.12	0.8	Negligible
H6	4.30	5.49	0.2	9.79	0.4	Negligible
H7	4.30	7.28	0.3	11.58	0.5	Negligible
H8	4.30	5.23	0.2	9.53	0.4	Negligible
H9	4.30	16.66	0.7	20.96	0.8	Negligible
H10	4.30	16.76	0.7	21.06	0.8	Negligible

Receptor	Background NH_3 Concentration Applied ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of AQAL	PEC ($\mu g/m^3$)	PEC as % of AQAL	Impact Descriptor
H11	4.30	2.46	<0.1	6.76	0.3	Negligible
H12	4.30	5.14	0.2	9.44	0.4	Negligible
H13	4.30	11.50	0.5	15.80	0.6	Negligible
H14	4.30	7.56	0.3	11.86	0.5	Negligible
H15	4.30	3.31	0.1	7.61	0.3	Negligible
H16	4.30	7.38	0.3	11.68	0.5	Negligible
H17	4.30	7.67	0.3	11.97	0.5	Negligible
H18	4.30	2.28	<0.1	6.58	0.3	Negligible
H19	4.30	1.82	<0.1	6.12	0.2	Negligible

All impacts (short and long term) are described as ‘negligible’, therefore the effect on air quality at human receptors as a result of NH_3 emissions is considered ‘not significant’.

6.7.4 NH_3 emissions at Ecological Receptors

Assessment of critical loads and critical levels at the sensitive ecological receptors identified is presented in Section 6.8.

6.8 Critical Levels and Loads

6.8.1 Critical Levels

The results of the assessment of impacts on C_{Le} (as a result of NO_X, SO_2 and NH_3 emissions) are presented in Table 6-22 below.

Further modelling assessment details and relevant significance criteria are presented within Appendix A and Appendix B.

Table 6-22
Impact on Critical Levels

Site	Averaging Period	Applied C_{Le} ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of C_{Le}
Howe Wood (AW)	NO_x Annual	30	0.8	2.7%
	NO_x 24-hour	75	9.3	12.4%
	SO_2 Annual	10 (A)	0.03	0.3%
	NH_3 Annual	1.0 (A)	0.04	3.8%
Markhams Wood (AW)	NO_x Annual	30	0.4	1.2%
	NO_x 24-hour	75	6.0	8.0%

Site	Averaging Period	Applied C_{Le} ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of C_{Le}
	SO_2 Annual	10 (A)	0.02	0.2%
	NH_3 Annual	1.0 (A)	0.01	0.6%
Hare Wood (AW)	NO_x Annual	30	0.1	0.4%
	NO_x 24-hour	75	3.7	5.0%
	SO_2 Annual	10 (A)	<0.01	<0.1%
	NH_3 Annual	1.0 (A)	<0.01	0.4%
Over and Lawn Woods (SSSI and AW)	NO_x Annual	30	0.2	0.7%
	NO_x 24-hour	75	4.3	5.8%
	SO_2 Annual	10 (A)	<0.01	<0.1%
	NH_3 Annual	1.0 (A)	0.008	0.8%
Littley Wood (AW)	NO_x Annual	30	0.2	0.6%
	NO_x 24-hour	75	2.7	3.6%
	SO_2 Annual	10 (A)	<0.01	<0.1%
	NH_3 Annual	1.0 (A)	0.02	2.1%
Cadge's Wood (AW) (B)	NH_3 Annual	1.0 (A)	0.50	50.0%
North Wood (AW) (B)	NH_3 Annual	1.0 (A)	0.03	3.2%
New Plantation (AW) (B)	NH_3 Annual	1.0 (A)	0.02	1.7%
Leys Wood (AW) (B)	NH_3 Annual	1.0 (A)	<0.01	0.3%

Table note:
(A) The lower SO_2 and NH_3 C_{Le} has been applied, reflecting a conservative approach (assuming the presence of lichens or bryophytes).
(B) Ecological receptor is located outside of the relevant screening distance from Site 1 (i.e. the only source of NO_X/SO_2 emissions identified), therefore NO_X/SO_2 concentrations have not been assessed at this receptor.

The findings are as follows:

- the short-term NO_X PC is below 10% of the short-term C_{Le} at the Over and Lawn Woods SSSI;
- the NO_X, SO_2 and NH_3 PC is below 1% of the long-term C_{Le} at the Over and Lawn Woods SSSI; and
- the NO_X, SO_2 and NH_3 PC is below 100% of the C_{Le} at the surrounding Ancient Woodlands.

Therefore the Proposed Development is considered to cause 'no likely damage' to the SSSI and 'no significant pollution' at the surrounding Ancient Woodlands.

6.8.2 Critical Loads

The results of the assessment of impacts on critical loads (as a result of NO_X, SO_2 and NH_3 emissions) are presented in Table 6-23 and Table 6-24 below.

Table 6-23
Impact on Nitrogen Critical Load

Site	Applied C_{Lo} (kg N/ha/yr)	PC [(A)] (kg N/ha/yr)	PC as % of C_{Lo}
Howe Wood (AW)	10	0.46	4.6%
Markhams Wood (AW)	10	0.12	1.2%
Hare Wood (AW)	10	0.05	0.5%
Over and Lawn Woods (SSSI, AW)	15	0.10	0.7%
Littley Wood (AW)	10	0.19	1.9%
Cadge's Wood (AW)	10	3.90	39.0%
North Wood (AW)	10	0.25	2.5%
New Plantation (AW)	10	0.13	1.3%
Leys Wood (AW)	10	0.03	0.3%

Table note:
(A) Process Contribution inclusive of contributions from NO_X and NH_3 from both combustion emissions and ammonia contribution.

Table 6-24
Impact on Acid Critical Load

Site	Applied C_{Lo} Max N (keq/ha/yr)	PC [(A)] (keq/ha/yr)	PC as % of C_{Lo}
Howe Wood (AW)	11.000	0.039	0.4%
Markhams Wood (AW)	11.000	0.012	0.1%
Hare Wood (AW)	11.004	0.005	<0.1%
Over and Lawn Woods (SSSI, AW)	11.006	0.009	<0.1%
Littley Wood (AW)	11.001	0.015	0.1%
Cadge's Wood (AW)	11.003	0.278	2.5%
North Wood (AW)	11.003	0.018	0.2%
New Plantation (AW)	11.020	0.010	<0.1%
Leys Wood (AW)	11.005	0.002	<0.1%

Table note:
(A) Process Contribution inclusive of contributions from N (NO_X and NH_3) and S (SO_2) from both combustion emissions and ammonia contribution.

The findings are as follows:

- the nitrogen and acid deposition PC does not exceed 100% of the C_{Lo} at the surrounding Ancient Woodlands; and

- the nitrogen and acid deposition PC does not exceed 1% of the C_{Lo} at the Over and Lawn Woods SSSI.

Therefore the Proposed Development is considered to cause ‘no likely damage’ to the SSSI and ‘no significant pollution’ at the surrounding Ancient Woodlands.

7.0 MITIGATION MEASURES

The proposed mitigation measures (for the construction and operational phase of the development) considered within this assessment are summarised below.

7.1 Construction Phase

IAQM guidance outlines several site-specific mitigation measures based on the assessed site risk, as displayed in Table 7-1. The measures are grouped into those which are highly recommended and those which are desirable.

Table 7-1
Construction Dust Mitigation Measures

Site Application	Mitigation Measures
Highly Recommended	
Communications	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
	Display the head or regional office contact information.
Monitoring	Carry out regular site inspections to monitor compliance with the Dust Management Plan (DMP), record inspection results, and make an inspection log available to the local authority when asked.
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
Operating Vehicle/Machinery and Sustainable Travel	Ensure all vehicles switch off engines when stationary - no idling vehicles.
	Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
	Use enclosed chutes and conveyors and covered skips.
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
Preparing and Maintaining the Site	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
	Avoid site runoff of water or mud.
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.

Site Application	Mitigation Measures
	Make the complaints log available to the local authority when asked.
	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook.
Waste Management	Avoid bonfires and burning of waste materials.
Desirable	
Communications	Develop and implement a DMP, which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, real time PM_{10} continuous monitoring and/or visual inspections.
Construction	Avoid scabbling (roughening of concrete surfaces) if possible.
	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
Monitoring	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100m of site boundary, with cleaning to be provided if necessary.
Operating Vehicle/Machinery and Sustainable Travel	Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
Operations	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Preparing and Maintaining the Site	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
	Keep site fencing, barriers and scaffolding clean using wet methods.
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
	Cover, seed or fence stockpiles to prevent wind whipping.
Trackout	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
	Avoid dry sweeping of large areas.
	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
	Record all inspections of haul routes and any subsequent action in a site logbook.

Site Application	Mitigation Measures
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

7.2 Operational Phase

The operational/containment measures proposed, which have been considered within this assessment, are outlined below:

- Covering (sheeting) of silage within the clamps;
- poultry litter and FYM to be enclosed within the Manure Shed, with air extracted to a dedicated abatement system;
- the digestate lagoons to be covered;
- the Separator building to be enclosed (passively ventilated); and
- a site management system to ensure routine site cleaning measures are undertaken (i.e. spillages cleared and not left in situ).

8.0 CONCLUSIONS

The construction phase assessment has concluded that the construction of the Proposed Development would result in a 'not significant' risk of impacts.

The operational phase assessment has concluded that the Proposed Development would result in a 'not significant' effect at human receptor locations with regard to odour, dust, ammonia, CHP and traffic emissions bioaerosols emissions screen out of the need for further assessment according to EA guidelines. With regard to ecological receptors the process emissions are considered to cause 'no likely damage' to the Over and Lawn Woods SSSI and 'no significant pollution' at the surrounding Ancient Woodlands.

APPENDIX A

CHP Emissions Assessment: Detailed Modelling

Detailed Modelling Parameters

For this assessment the AERMOD model[27] has been applied; this model is widely used and accepted by the EA for undertaking such assessments and its predictions have been validated against real-time monitoring data by the United States (US) Environmental Protection Agency (EPA). It is therefore considered a suitable model for this assessment.

Model Domain / Receptors

The modelling has been undertaken using a receptor grid across a map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum ground level concentration outside the Site boundary to be assessed.

A nested receptor grid of 2.5km by 2.5km centred upon Site 1 was applied as follows:

- 100m x 100m at 10m grid resolution;
- 500m x 500m at 25m grid resolution;
- 1000m x 1000m at 50m grid resolution;
- 1500m x 1500m at 100m grid resolution; and
- 2500m x 2500m at 200m grid resolution.

In addition, the modelling of discrete sensitive receptor locations, as described in Section 4.1, was undertaken to assess the impact at relevant exposure locations for annual mean impact and facilitate the discussion of results.

Topography

The presence of elevated terrain can affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights.

Site 1 lies at approximately 85m above ordnance datum (AOD) in a predominantly rural area on the outskirts of Haverhill. Site 1 is situated in a shallow depression in the land, with elevations rising to the north, south and west to a height of approximately 100m AOD. Elevations fall to the east (in the direction of Haverhill) to a height of approximately 70m AOD. Topography has been incorporated into the model and is illustrated in Figure A-1 below.

[27] Software used: Lakes AERMOD View, (Executable Aermod_21112).

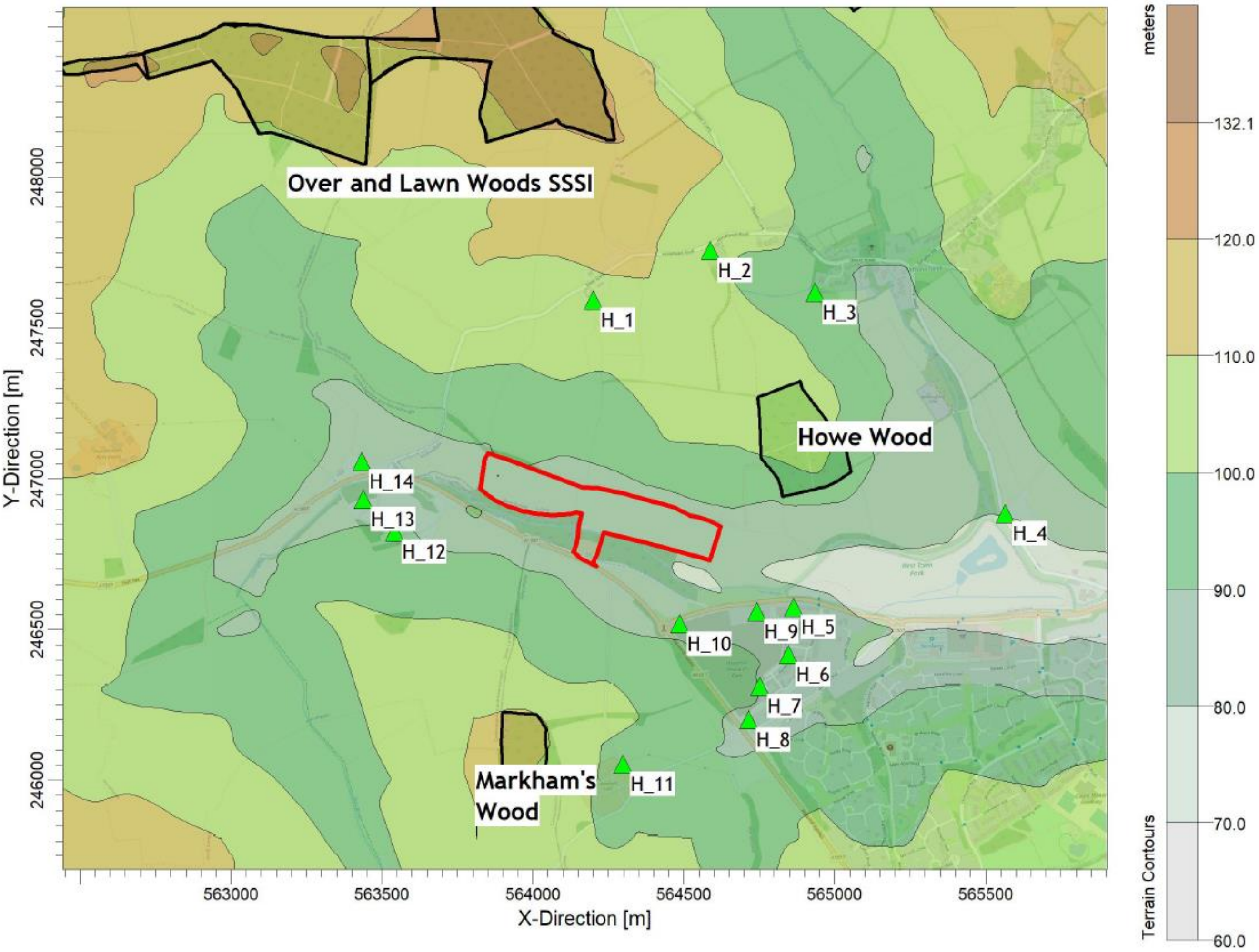


Figure A-1
Surrounding Topography - Site 1

Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. Building downwash has been considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which are within a distance defined as five times the lesser of the height or maximum projected width of the building.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Buildings input to the model are represented in blue in Figure A-2, and emission stacks in red.

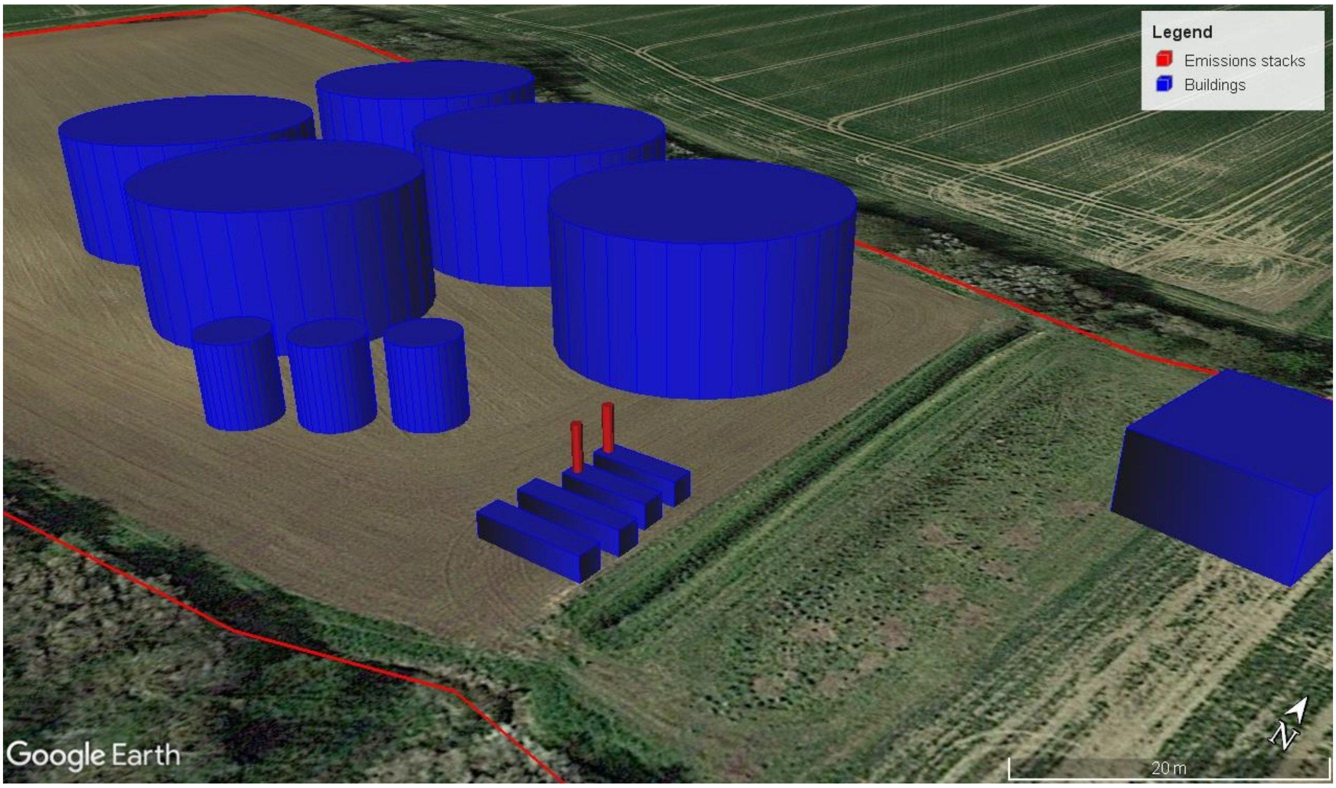


Figure A-2
Modelled Buildings and Structures – CHP Emissions

Meteorological Data and Preparation

The nearest meteorological recording station to the Proposed Development is the Cambridge meteorological recording station, located approximately 19km to the northwest. However in consideration of the surrounding land use (urban) and elevation of the Cambridge meteorological recording station (15m) in comparison to the Proposed Development (85-100m elevation, rural area), this station was not considered representative of the Site locale.

The Andrewsfield meteorological recording station is the next closest to the Proposed Development (located 24km to the south), located in a setting more similar to that of the Proposed Development (80m elevation, rural). A windrose from the Andrewsfield meteorological recording station, showing the frequency of wind speed and direction, used in the assessment is presented in Section 4.5. The windrose shows winds from the south-west are most prevalent.

The meteorological data (5 years hourly sequential data for 2017-2021 inclusive) was obtained in .met format from the data supplier. The data was converted to the required surface and profile formats for use in AERMOD, in accordance with the latest guidance[28], using AerMet View meteorological pre-processor. Details specific to the meteorological recording station location were used to define surface roughness, albedo and bowen ratio (as presented in Table A-1 below) in the conversion using the AerSurface tool within AerMet.

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[28] AERMOD Implementation guide. AERMOD implementation workgroup, USEPA. Last revised June 2022.

Table A-1
Applied Surface Characteristics

Zone (Start)	Zone (End)	Albedo	Bowen Ratio	Surface Roughness (m)
0	360	0.18	0.56	0.25

Table note:
In reference to the land use data source applied (CORINE CLC2012), the land use classification of the entire area within 1km of the recording station is 'Pasture / Hay'.

Dispersion Coefficients

The 'rural' option for dispersion coefficients was selected in accordance with AERMOD guidance.

Dispersion Model Uncertainty

Model validation studies[29] for AERMOD generally suggest that these dispersion models are for the vast majority of cases able to predict maximum short term high percentiles concentrations well within a factor of two and the latest evaluation study for AERMOD shows the composite (geometric mean) ratio of predicted to observed short-term averages from 'test sites' (where real-time monitoring data is available to validate model performance), to be between 0.96 and 1.2.

NO_X to NO_2 Conversion

NO_x emitted to atmosphere as a result of combustion will consist largely of nitric oxide (NO), a relatively innocuous substance. Once released into the atmosphere, NO is oxidised to NO_2. The proportion of NO converted to NO_2 depends on a number of factors including wind speed, distance from the source, solar radiation and the availability of oxidants, such as ozone (O_3).

A worse-case scenario has been applied in that 35% of NO_x is presented as NO_2 in relation to short-term impacts and 70% of NO_x is present as NO_2 in relation to long-term impacts in accordance with the EA's AQMAU guidance[30] on the conversion ratio for NO_x and NO_2.

SO_2 15-minute Mean Averaging Period

As dispersion models utilise hourly average meteorological data, calculation of 15-minute averages, such as required for SO_2, requires the application of conversion factors. For the purposes of detailed modelling of SO_2, a conversion factor of 1.34 is applied to the hourly average data, as detailed in the AERA guidance.

Assessment of Impacts on Human Receptors

The significance of effects on human receptors will be assessed on the basis of the EPUK & IAQM guidance, which presents a matrix to establish the magnitude of impact on individual receptors based upon the percentage change relative to the AQAL. The impact at an individual receptor is identified as 'negligible', 'slight', 'moderate' or 'substantial'. The impact can be either 'adverse' (due to concentration increase) or 'beneficial' (due to concentration decrease).

The impact at individual receptors is dependent upon the long-term average pollutant concentration at the receptor in the assessment year and the percentage change relative to the AQAL.

Reference should be made to Table A-2 for presentation of the impact descriptors used within the assessment of long-term concentrations and Table A-3 for short-term concentrations.

[29] AERMOD: Latest Features and Evaluation Results, EPA-454/R-03-003, June 2003 (United States Environmental Protection Agency).
[30] Environment Agency, Air Quality Modelling and Assessment Unit, 'Conversion Ratios for NOx and NO_2' (no date).

Table A-2
Impact Descriptors – Assessment of Long-term Concentrations

Long-term Concentration with development at receptor location	Percentage Change in Long-term Concentration Relative to AQAL				
	<0.5	1	2 – 5	6 – 10	>10
<75% of the AQAL	Negligible	Negligible	Negligible	Slight	Moderate
75 – 95% of the AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95 – 103% of the AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103 – 110% of the AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
>110% of the AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

Table A-3
Impact Descriptors – Assessment of Short-term Concentrations

Impact Descriptor	Maximum Predicted Short-term Concentration as % of AQAL
Substantial	>50
Moderate	20 – 50
Slight	10 – 20
Negligible	<10

The predicted impacts will be used to determine the significance of the overall effect; which is dependent on a number of factors. Therefore, professional judgement will be applied to determine the likely significance of effects, with the following factors considered:

- the existing and future air quality in the absence of the development, notably whether the AQALs are likely to be met or the scale of exceedances in the long-term and short-term mean concentrations;
- the extent of current and future population exposure to the predicted impacts, notably the number of properties and/or people present and the scale of impact (e.g. whether the majority of the local population is subject to substantial or slight magnitude impacts); and
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts, such as establishing a worst-case scenario for sensitive receptors.

If the overall impact is described as 'substantial', or there is a predicted exceedance of any considered AQAL at a location of relevant exposure, the predicted effect on air quality may be considered "significant".

Assessment of Impacts on Vegetation and Ecosystems

Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[31]. Dry deposition flux was calculated using the following equation:

Dry deposition flux (µg/m^2/s) = ground level concentration (µg/m^3) x deposition velocity (m/s)

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow, and is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered.

The applied deposition velocities for the relevant chemical species are as presented in Table A-4.

Table A-4
Applied Deposition Velocities

Chemical Species	Recommended deposition velocity (m/s)	
NO_2	Grassland	0.0015
	Woodland	0.0030
SO_2	Grassland	0.0120
	Woodland	0.0240

Critical Loads

C_{Lo} for the habitats and species of relevance to this assessment have been obtained from the APIS website.

Critical Loads – Eutrophication / Nutrient Nitrogen

C_{Lo} for nitrogen deposition (N) are recorded in units of kgN/ha/yr. The deposition PC is converted from µg/m^2/s to units of kgN/ha/yr by multiplying the dry deposition flux by the standard conversion factor of 95.9 for NO_2.

Critical Loads – Acidification

The predicted deposition rates are converted to units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be, by multiplying by the dry deposition flux (µg/m^2/s) by the standard pollutant specific conversion factors presented within Table A-5.

Table A-5
Applied Acidification Conversion Factors

Chemical Species	Conversion factor to keq/ha/year
NO_2	6.84
SO_2	9.84

[31] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014 version.

Calculation of PC as a percentage of Acid Critical Load Function

The calculation of the process contribution of N and S to the acid C_{Lo} function has been carried out according to the guidance on the APIS, which is as follows:

> *'The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than CLminN will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less that CLminN only the acidifying affects of sulphur from the process need to be considered:*
>
> *Where PEC N Deposition < CLminN*
>
> *PC as % CL function = (PC S deposition/CLmaxS)*100*
>
> *Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.*
>
> *Where PEC N Deposition > CLminN*
>
> *PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100'*

Assessment of Impact and Significance

In addition to the AERA guidance, the EA's Operational Instruction 66_12[32] details how air quality impacts on ecological sites should be assessed. This guidance provides risk-based screening criteria to determine whether impacts will have 'no likely significant effects for European sites, 'no likely damage' for Sites of Special Scientific Interest (SSSIs), or 'no significant pollution' for other sites, as follows:

- PC does not exceed 1% long-term C_{Le} and/or C_{Lo} or that the PEC does not exceed 70% long-term C_{Le} and/or C_{Lo} for European sites and SSSIs; and
- PC does not exceed 10% short-term C_{Le} for NO_x for European sites and SSSIs;
- PC <100% long-term C_{Le} and/or C_{Lo} for other conservation sites; and
- PC <100% short-term C_{Le} for NO_x (if applicable) for other conservation sites.

[32] EA Operational Instruction 66_12 - Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Issued 08/05/2012.

Modelling Results - Isopleth plots

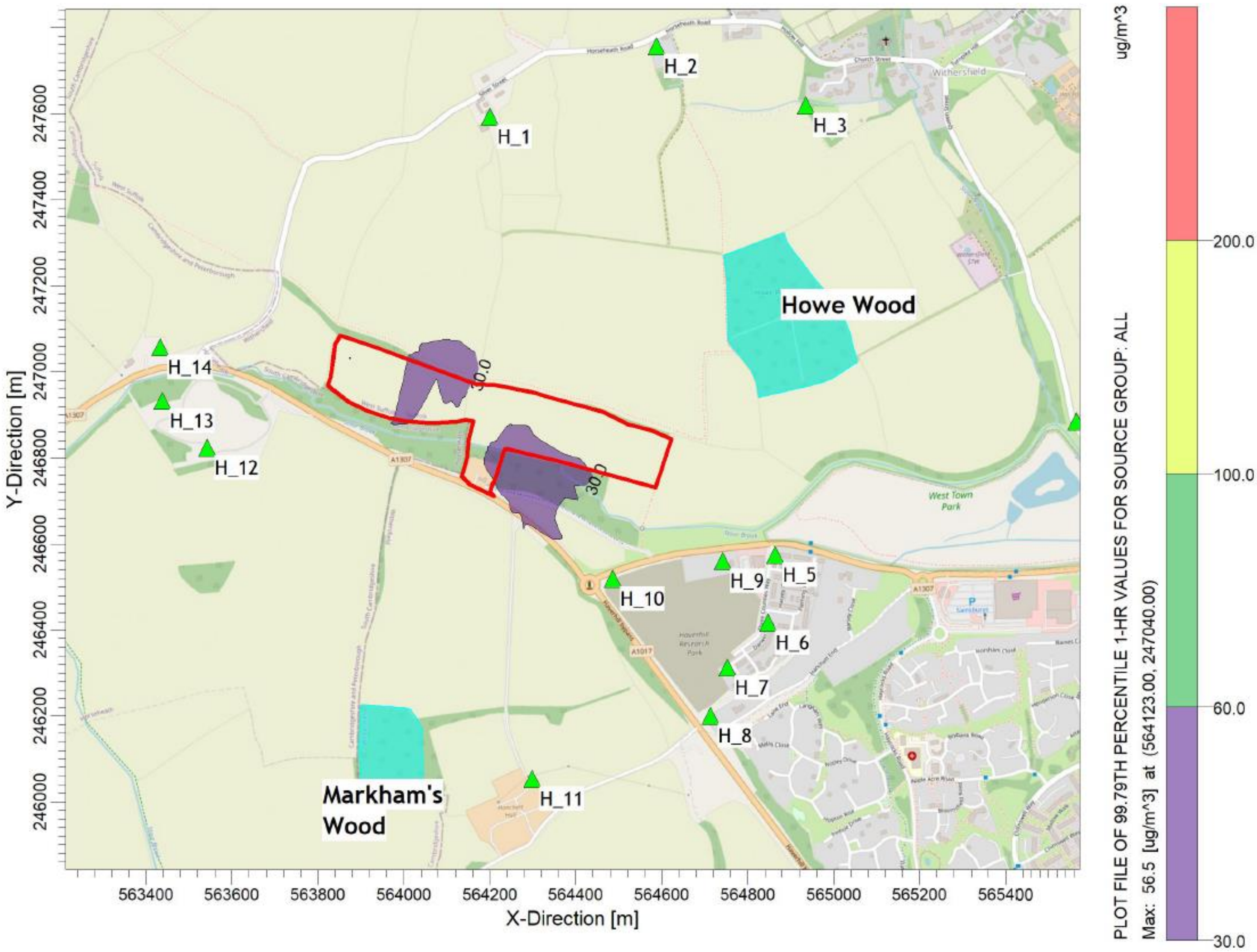

Figure A-3
1-hour Mean (99.79%ile) Nitrogen Dioxide Process Contribution for Meteorological Year 2017

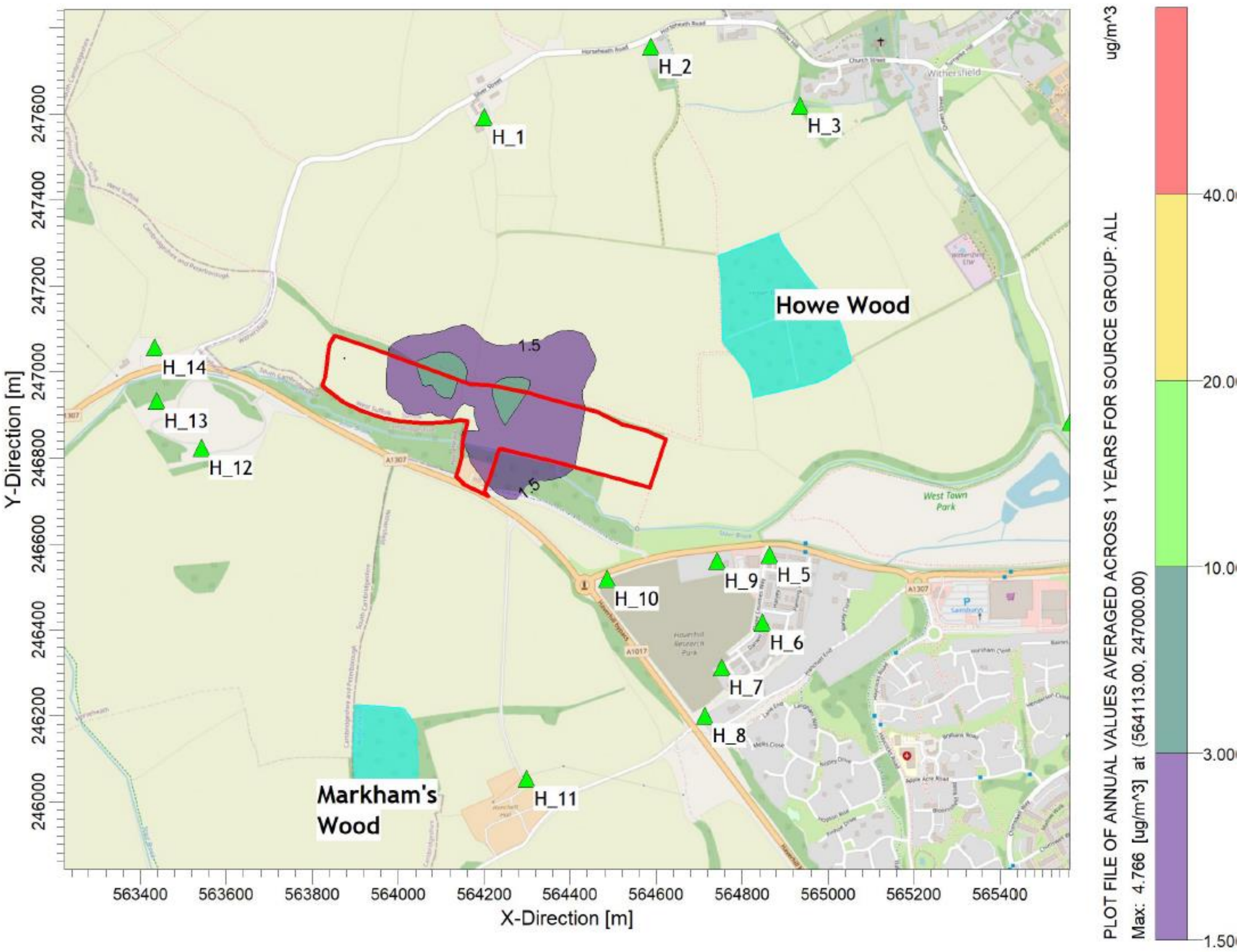

Figure A-4
Annual Mean Nitrogen Dioxide Process Contribution for Meteorological Year 2017

APPENDIX B

Ammonia Emissions Assessment: Detailed Modelling

Detailed Modelling Parameters

For this assessment the AERMOD model[33] has been applied; this model is widely used and accepted by the EA for undertaking such assessments and its predictions have been validated against real-time monitoring data by the United States (US) Environmental Protection Agency (EPA). It is therefore considered a suitable model for this assessment.

Model Domain / Receptors

As presented in Appendix A for Site 1. In addition to this a nested receptor grid of 1.5km by 1.5km centred upon Site 2 was applied as follows:

- 100m x 100m at 10m grid resolution;
- 500m x 500m at 25m grid resolution;
- 1000m x 1000m at 50m grid resolution; and
- 1500m x 1500m at 100m grid resolution.

Topography

As presented in Appendix A for Site 1.

Site 2 lies at approximately 105m above ordnance datum (AOD) in a rural agricultural setting northwest of Haverhill. Site 2 is situated in a gentle slope, with elevations rising to the north, east and west to a height of approximately 120m AOD. Elevations fall to the southeast to a height of approximately 90m AOD. Topography has been incorporated into the model and is illustrated in Figure A-1 below.

[33] Software used: Lakes AERMOD View, (Executable Aermod_22112).

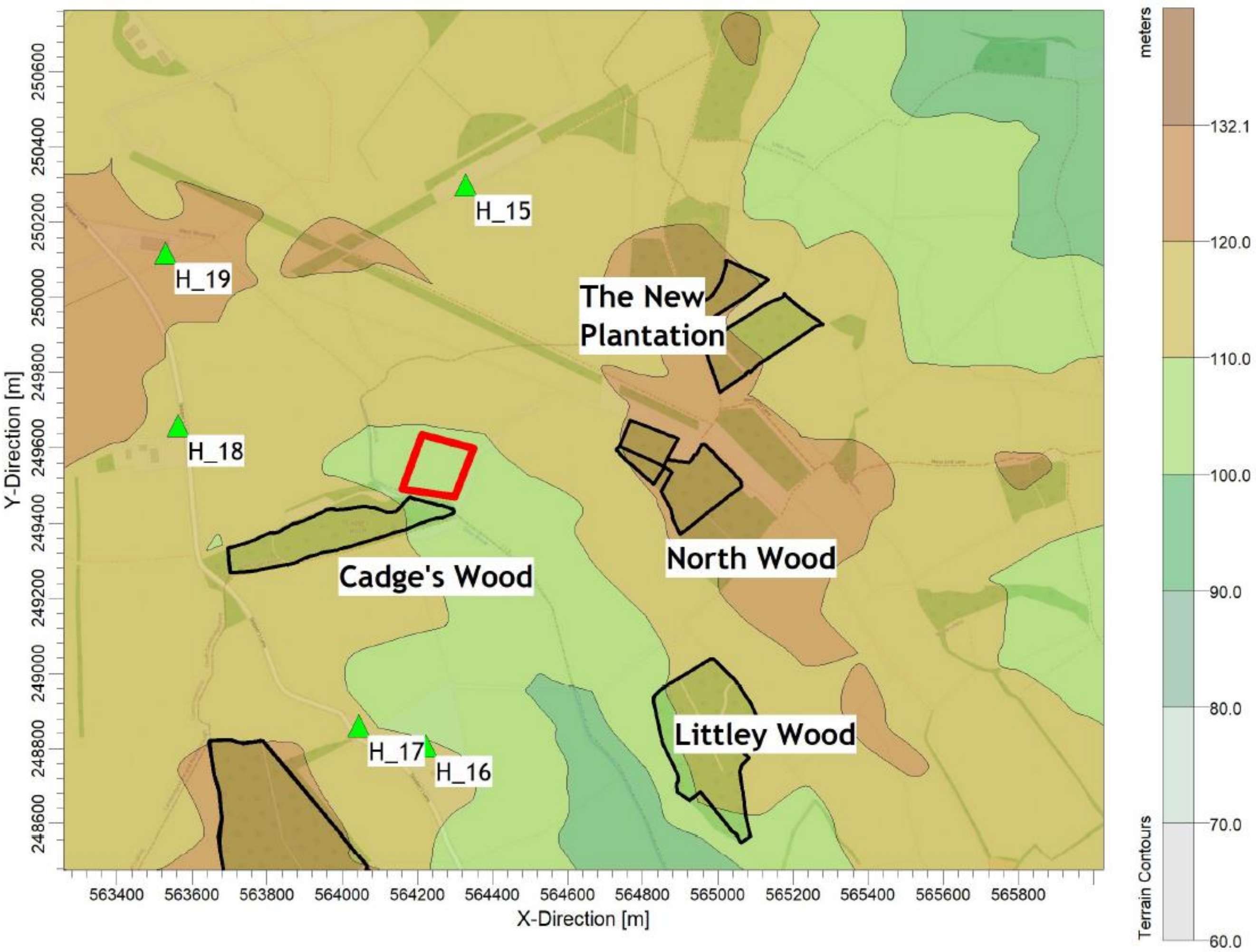

Figure B-5
Surrounding Topography – Site 2

Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. Building downwash has been considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which are within a distance defined as five times the lesser of the height or maximum projected width of the building.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. In regard to ammonia emissions, a single stack source has been considered; the Manure Shed abatement system. The buildings input to the model are represented in blue in Figure B-2, and the emission stack in red.

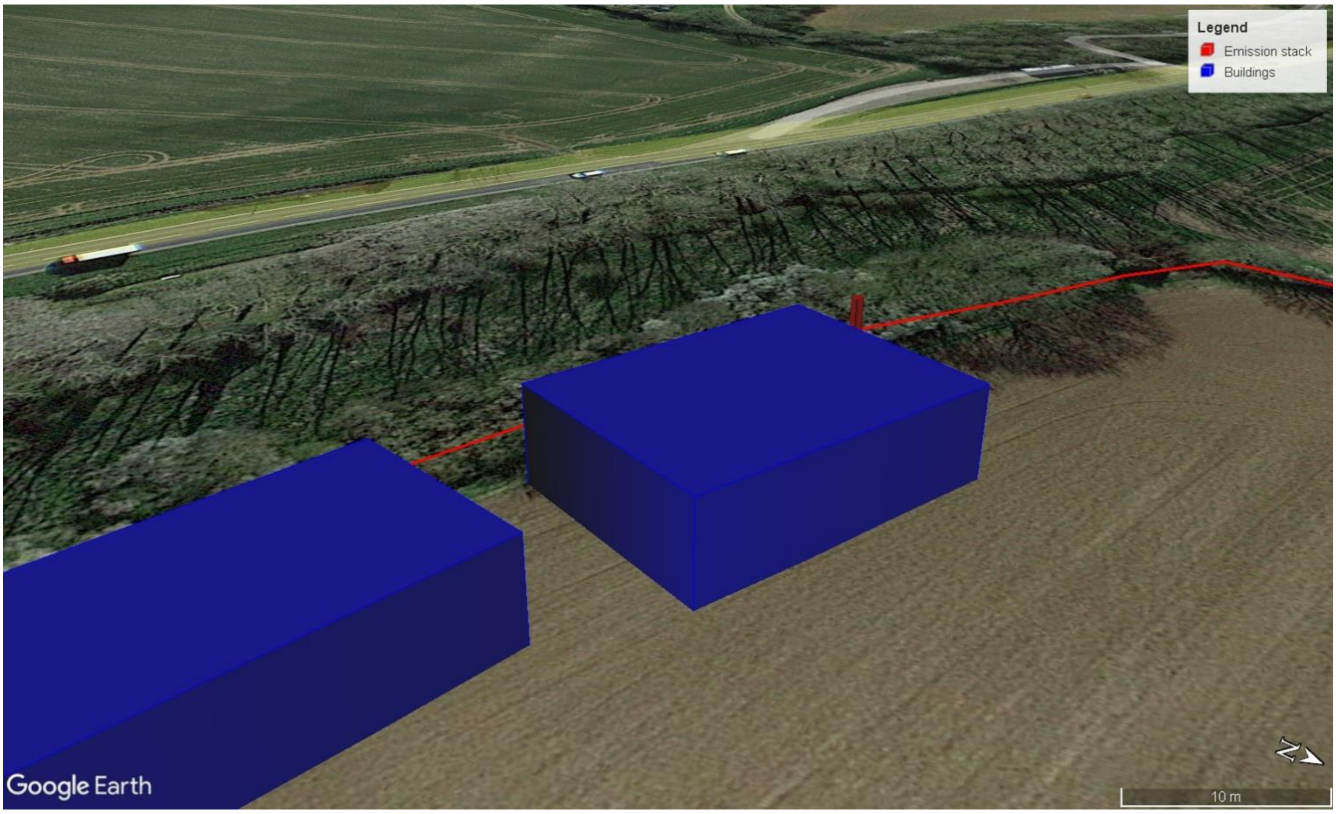

Figure B-2
Modelled Buildings and Structures – Ammonia Modelling

Meteorological Data and Preparation

As presented in Appendix A.

Dispersion Coefficients

As presented in Appendix A.

Dispersion Model Uncertainty

As presented in Appendix A.

Assessment of Impacts on Human Receptors

As presented in Appendix A.

Assessment of Impacts on Vegetation and Ecosystems

Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[34]. Dry deposition flux was calculated using the following equation:

Dry deposition flux (µg/m^2/s) = ground level concentration (µg/m^3) x deposition velocity (m/s)

[34] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014 version.

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow, and is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered.

The applied deposition velocities for the relevant chemical species are as shown in Table B-1

Table B-1
Applied Deposition Velocities

Chemical Species	Recommended deposition velocity (m/s)	
NH_3	Grassland	0.020
	Woodland	0.030

Critical Loads

C_{Lo} for the habitats and species of relevance to this assessment have been obtained from the APIS website.

Critical Loads – Eutrophication / Nutrient Nitrogen

C_{Lo} for nitrogen deposition (N) are recorded in units of kgN/ha/yr. The deposition PC is converted from µg/m^2/s to units of kgN/ha/year by multiplying the dry deposition flux by the standard conversion factor of 260 for NH_3.

Critical Loads – Acidification

The predicted deposition rates are converted to units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be, by multiplying by the dry deposition flux (µg/m^2/s) by the standard pollutant specific conversion factors presented within Table B-2.

Table B-2
Applied Acidification Conversion Factors

Chemical Species	Conversion factor [kg/ha/year to keq/ha/year]
NH_3	18.5

Calculation of PC as a percentage of Acid Critical Load Function

As presented in Appendix A.

Assessment of Impact and Significance

As presented in Appendix A.

Modelling Results - Isopleth plots

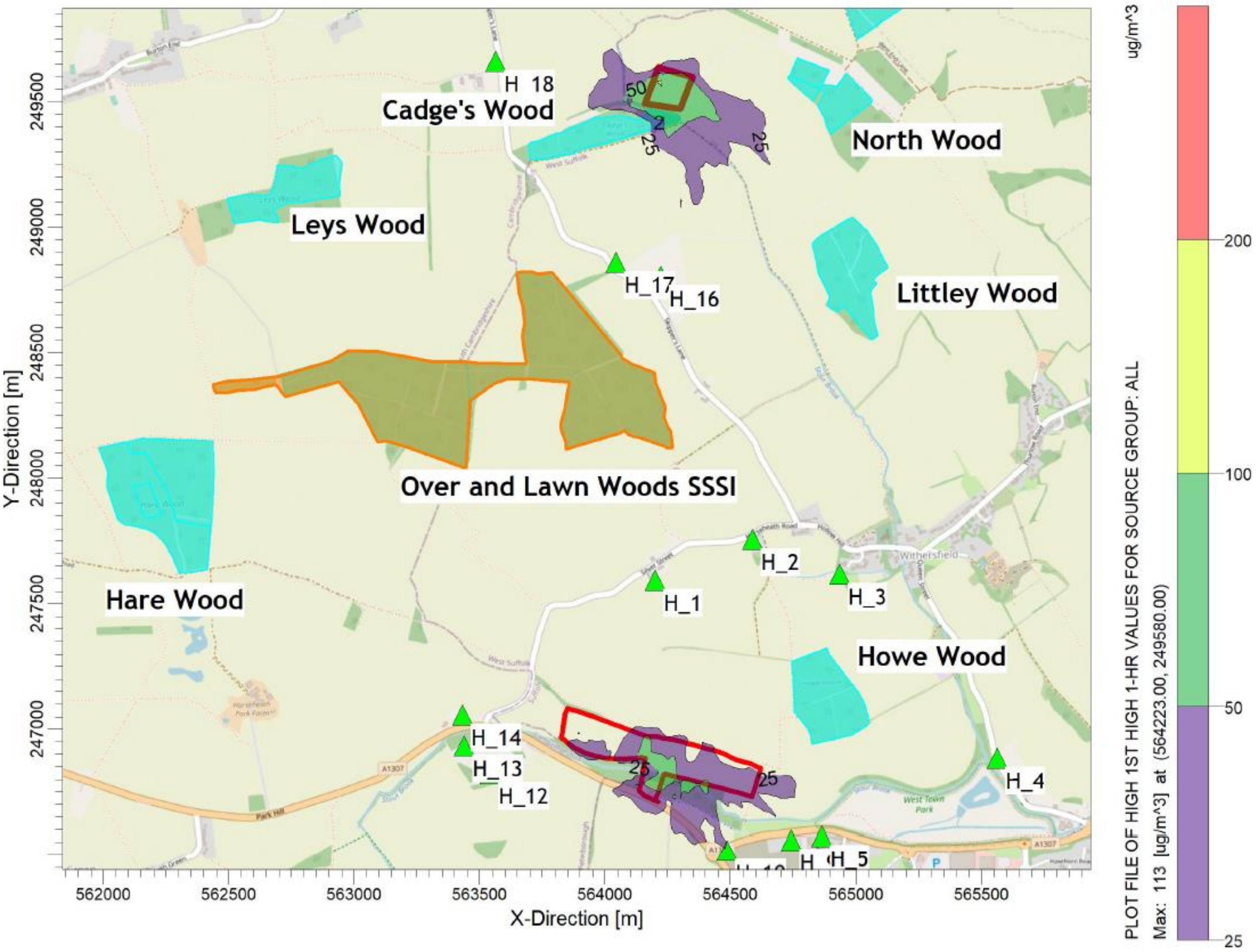

Figure B-2
1-hour Mean Ammonia Process Contribution for the 5-year Average (2017-21)

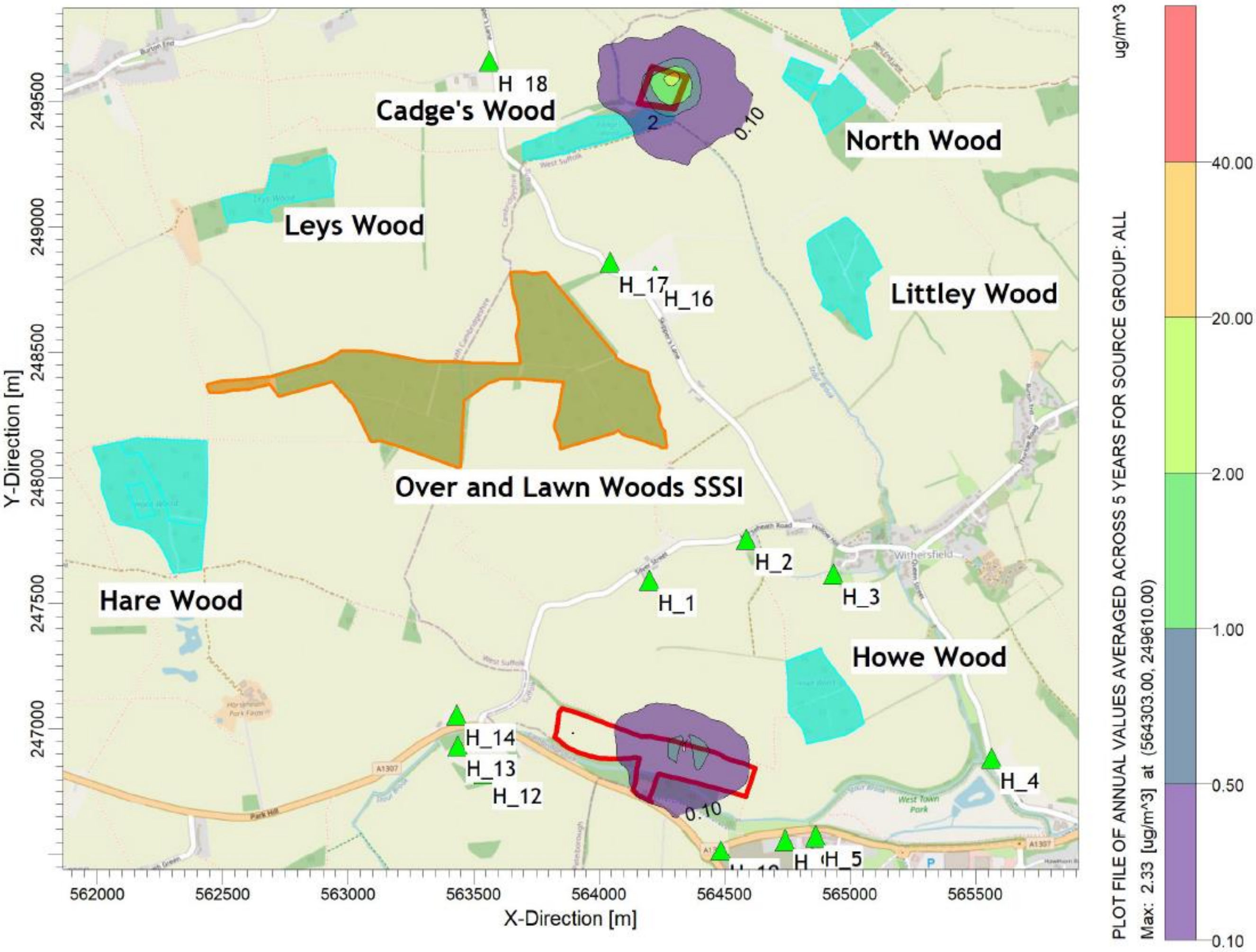

Figure B-3
Annual Mean Ammonia Process Contribution for the 5-year Average (2017 - 2021)

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