

Assessing the impact and effects of ammonia and nitrogen on designated sites from planning application for new and expanding intensive livestock units in Shropshire

Shropshire Council Ecology Team

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1 INTRODUCTION

- 1.1 This document provides guidance on how to assess the impacts of ammonia emissions and associated nitrogen deposition arising from planning applications for intensive livestock units (ILU) on designated international¹ and national² wildlife sites and habitats identified as irreplaceable assets within the National Planning Policy Framework including ancient woodland, hereafter referred to collectively as 'designated sites'³.
- 1.2 It is aimed at applicants and their planning agents, ecology and air pollution consultants who are seeking to apply for planning permission to build and operate intensive livestock units in Shropshire, including changes to existing permissions.
- 1.3 As this is a complicated technical issue, it is advised that applicants seek pre-application advice from the local planning authority at an early stage by e-mailing ecology@shropshire.gov.uk. There is a fee for this service.
- 1.4 Recent interim guidance⁴ as been issued by Natural England and the Environment Agency with regards to their assessment of air quality risk for planning applications and environmental permits respectively which could have a likely significant effect on international sites. Their guidance acknowledges that at the moment there are differing approaches to thresholds of insignificance with regards to air quality pollutants, however it is stressed that the agencies are working together currently so that in the long-term alignment is hoped to be achieved. In addition, Natural Resources Wales have also updated their guidance, which is available online.
- 1.5 Shropshire Council have therefore taken the decision to update the guidance it originally published in 2018. This new guidance is partly informed by the latest guidance published by Natural Resources Wales and Natural England but adapted and expanded to be in line with approaches and guidance for other sectors (such as industry and transportation), as well as published best practice guidance documents published by the Institute of Air Quality Management and the Chartered Institute of Ecology and Environmental Management.

¹ Special Areas of Conservation, Special Protection Areas and Ramsar sites

² Sites of Special Scientific Interest and Local Nature Reserves

³ Information on designated sites is available from <https://magic.defra.gov.uk/>

⁴ May 2022 Air Quality Risk Assessment Interim Guidance-Joint NE/AE External Lines

2 THE ASSESSMENT PROCESS

- 2.1 The process to be followed can broadly be separated into two parts. The first is an assessment of air quality impacts and the second is an Ecological Impact Assessment.

Air quality Impacts

- 2.2 Planning applications for an intensive livestock unit will always require a report on air quality impacts.
- 2.3 Tables 1 to 3 describe the process of assessing modelled air quality impacts, which should be undertaken by a suitably qualified and experienced air quality expert, and Figure 1 illustrates the procedure in a flow chart.
- 2.4 Reference to Environment Agency guidance and thresholds with regards to their environmental permitting role for the intensive livestock sector is **not** applicable to planning applications and should not be used in air quality reports. Planning and environmental permitting are separate regimes considering differing criteria and obtaining permission under one regime does not ensure permission will be gained through the other.

Emissions from Free Range Poultry

- 2.5 For free-range poultry, the appropriate emission factor will need to be apportioned between the free-range area and any housing. We require that modelling assumes that 20% of droppings will occur outside the housing. This will only change if agreed with other UK regulators.
- 2.6 Utilising published emission factors for housing and free-range areas, the following method should be used:
- i. Select the appropriate housing emission factor and multiply this by 80% of the total flock size.
 - ii. Multiply the free-range emission factor by the total flock size⁵.
 - iii. Add these together.
- 2.7 The emission factor to utilise for the free-range ranging area is available on NRW's website: (Natural Resources Wales / Emission factors for poultry for modelling and reporting).

Ecological effects

- 2.8 An Ecological Impact Assessment is required where air quality impacts in relation to ecology cannot be deemed as insignificant purely on modelled outputs.
- 2.9 Section 4 of this guidance provides information to assist with the assessment of the significance of effects of air quality impacts on designated sites, which should be undertaken by an appropriately qualified and experienced ecologist.
- 2.10 It is for the applicant to provide the assessment of the effects a project has on designated sites in order for a planning application to be assessed in accordance with national and local policy. It is not acceptable therefore, to only submit an air quality

⁵ The free-range emission factor already assumes that 20% of the total flock will be outside, therefore it does not need to be altered.

modelling report which concludes that ammonia emissions or nitrogen loads will, either alone or in-combination, exceed 1% of the critical level or critical load, even after the implementation of Best Available Techniques.

Definition of terms used in Tables 1, 2 & 3

Abbreviation	Term	Description
BAT	Best Available Techniques	Measures to reduce ammonia emissions detailed in document ' <i>Commission Implementing Decision (EU) 2017/302 of 15 February 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the intensive rearing of poultry or pigs</i> '
	Background	When used in the context of concentration or deposition rate of a pollutant, this refers to the average over a 1 km by 1 km grid.
CLe	Critical Level	Level of airborne ammonia above which adverse effects to a specified habitat is likely to occur, according to present knowledge. Usually measured in units of $\mu\text{g}/\text{m}^3$.
CLo	Critical Load	Amount of nitrogen deposition below which significant harmful effects on sensitive ecosystems do not occur, according to present knowledge. Usually measured in units of kilograms per hectare per year (kg/ha/yr).
PC	Process Contribution	Ammonia released to the air or nitrogen (N) deposited to the ground as a result of the proposal.
PEC	Predicted Environmental Concentration	PC plus the background level or load at the sensitive receptor.
iPEC	In-combination Predicted Environmental Concentration	Sum of PCs plus the background level or load at the sensitive receptor.
Sum of PCs	Sum of Process Contributions	The PC of the LSU being applied for plus the PCs of other sources being considered in-combination.

TABLE 1: DESK STUDY			
Assessment stage	Consideration	Contextual information	Next steps
Step 1: Identifying the scale of the project	<p>'Large' projects are defined as follows:</p> <ul style="list-style-type: none"> • 32,000 or more caged layers • 100,000 or more caged layers • 200,000 or more broilers • 1,500 or more pigs • 32,000 or more non-chicken 	As described in planning application documentation.	Proceed to Step 2.
Step 2: Distance screen	<p>For 'large' projects, a buffer of 10km should be used for international sites, a 5km buffer used for SSSIs (or a larger/smaller buffer in accordance with published IRZs) and a 2km buffer for ancient woodland.</p> <p>For all other projects, international and national sites should have a 5km buffer applied (or a larger/smaller buffer in accordance with published IRZs) and a 2km buffer for ancient woodland.</p>	<p>Refer to Natural England's Impact Risk Zones for international sites and SSSIs:</p> <ul style="list-style-type: none"> - ssi irz user guidance magic.pdf (defra.gov.uk) - Information can be obtained from: http://www.magic.gov.uk/MagicMap.aspx - Natural England https://designatedsites.naturalengland.org.uk/SiteSearch.aspx 	<p>If the intensive livestock unit does not fall within any of the relevant distances for sites, the proposal is considered unlikely to have a significant effect on designated sites as a result of ammonia emissions and NO FURTHER ASSESSMENT IS REQUIRED.</p> <p>If the intensive livestock unit does fall within any of the relevant distances for designated sites, proceed to Step 3</p>
Step 3: Site sensitivity check	Check that sites screened in due to distance are sensitive to the impacts of ammonia, including nitrogen deposition.	<p>For instance, geological SSSIs will not be sensitive to ammonia and some rivers may also not be sensitive. All ancient woodlands are potentially sensitive to ammonia impacts.</p> <p>Information on sites' sensitivities is available from</p> <ul style="list-style-type: none"> - Site Relevant Critical Loads and Source Attribution Air Pollution Information System (apis.ac.uk) 	If one or more site is sensitive to the effects of ammonia, this needs further investigation. Proceed to Step 4.

Step 4: Search for other projects	Consideration must be given as to whether the project needs to be assessed 'in-combination' with other ammonia emitting projects.	<p>Only those projects (or plans) which are 'live' at the time of the assessment should be taken into account for an in-combination assessment and therefore include:</p> <ul style="list-style-type: none"> • Plans or projects currently subject to an application for consent (e.g. a validated planning application, pending a decision). • Projects that are subject to an outstanding appeal. • Projects that have been approved, but which have not yet started operating and the planning permission is still valid. • Projects that are not in the current APIS background. (Ammonia background concentration and nitrogen background deposition from APIS are given as an average over three years. If projects started operating, or were given consent, after 31 December of the second year of the current three-year APIS average they will not be in the background and will, therefore, need to be taken into account in an in-combination assessment). <p>Applicants are advised to contact the ecology team at Shropshire Council in order to identify any other projects or plans which should also be considered as part of the assessment. There will be a fee for this service.</p> <p>- ecology@shropshire.gov.uk</p>	<p>If there are no projects or plans identified to assess in combination, proceed to Table 2 (Step 5).</p> <p>If there are other projects or plans to assess in combination, proceed to Table 3 (Step 8).</p>
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TABLE 2: ASSESSMENT OF PROJECT ALONE			
Assessment Stage	Consideration	Contextual information	Next steps
Step 5: Screening alone	Undertake modelling and analyse the PC against ammonia critical levels and nitrogen critical loads for	Modelling must be undertaken by a suitably experienced and qualified air quality modeller.	<p>If the PC is >1% of CLe/CLo proceed to Step 5.</p> <p>If the PC is <1% of CLe/CLo, the proposal is considered unlikely to</p>

	each site screened in for consideration.	<p>The model used must be fit for purpose, based on established science and be validated and independently reviewed.</p> <p>The ammonia critical level and nitrogen critical load for each sensitive receptor and background levels for the locality can be obtained from one or more of the following sources:</p> <ul style="list-style-type: none"> - Site Relevant Critical Loads and Source Attribution Air Pollution Information System (apis.ac.uk) - For Ramsar sites, the CLo/CLe should be obtained based upon the habitat type(s) the site is designated for. <p>Sensitive receptors may be established from site citations:</p> <ul style="list-style-type: none"> - https://designatedsites.naturalengland.org.uk/SiteSearch.aspx 	have a significant effect on designated sites as a result of ammonia emissions and NO FURTHER ASSESSMENT IS REQUIRED.
Step 5: Exceedance check alone	Determine the background ammonia concentrations and nitrogen deposition rates and undertake detailed modelling to calculate the Predicted Environmental Concentration (Process Contribution (PC) + Background Ammonia concentrations / N deposition) at each site.	<p>Background ammonia concentrations and nitrogen deposition at the designated site(s) can be sourced from:</p> <ul style="list-style-type: none"> - https://www.apis.ac.uk/app <p>Note that background levels of ammonia in Shropshire are already over most CLe and CLo for designated sites.</p>	<p>If the PEC causes an exceedance of the CLe or CLo proceed to Step 6.</p> <p>If the PEC does not cause an exceedance of the CLe or CLo, the proposal is considered unlikely to have a significant effect on designated sites as a result of ammonia emissions and NO FURTHER ASSESSMENT IS NORMALLY REQUIRED, however, there may be occasions where the background is close to the CLe/CLo and even if the proposal does not cause an exceedance of</p>

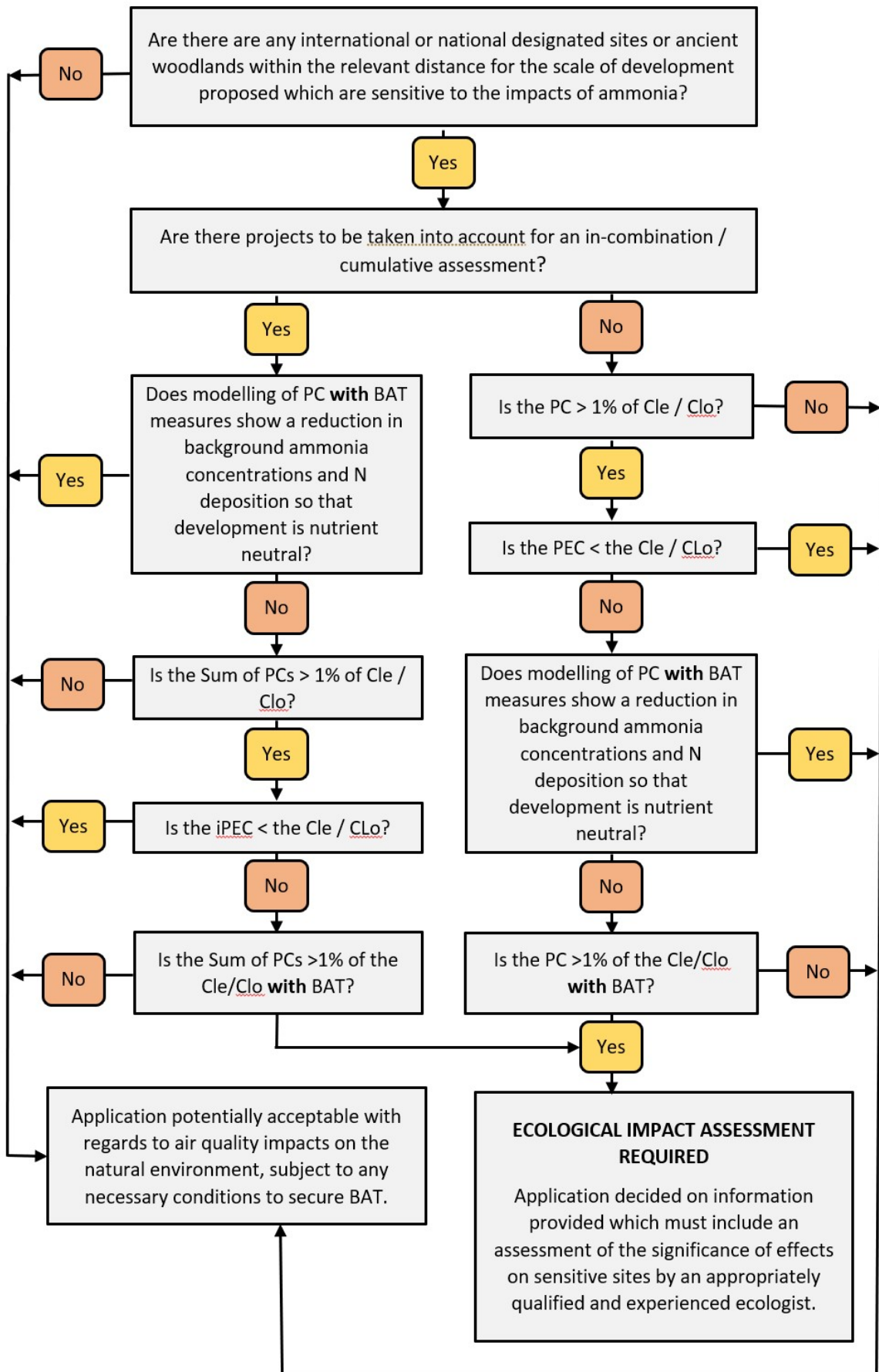
			the CLe/ CLo, further consideration may be necessary.
Step 6: Best Available Technology (BAT) measures	Undertake modelling of the PC including Best Available Techniques (BAT) to reduce ammonia emissions.	<p>Measures to reduce ammonia emissions from intensive livestock units are detailed in ‘<i>Commission Implementing Decision (EU) 2017/302 of 15 February 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the intensive rearing of poultry or pigs</i>’ available at:</p> <ul style="list-style-type: none"> - https://publications.europa.eu/en/publication-detail/-/publication/968ab1da-f807-11e6-8a35-01aa75ed71a1/language-en <p>NRW has information about BAT measures used to reduce ammonia emissions:</p> <ul style="list-style-type: none"> - Natural Resources Wales / Reducing ammonia emissions from agriculture <p>Information about ammonia scrubber design and use can be found on the NRW website:</p> <ul style="list-style-type: none"> - Natural Resources Wales / Ammonia scrubber design and use 	<p>If the PC modelled with BAT shows that ammonia concentration and nitrogen deposition is reduced by more than or equal to the PC the proposal is considered unlikely to have a significant effect on designated sites as a result of ammonia emissions and NO FURTHER ASSESSMENT IS REQUIRED.</p> <p>If the PC modelled with BAT does not show that ammonia concentration and nitrogen deposition will be reduced by more than or equal to the PC, proceed to Step 7.</p>
Step 7: PC with BAT screen alone	Analyse the PC including BAT against ammonia critical levels and nitrogen critical loads for each site screened in for consideration.		<p>If the PC modelled with BAT is <1% of CLe/CLo the proposal is considered unlikely to have a significant effect on designated sites as a result of ammonia emissions and NO FURTHER ASSESSMENT IS REQUIRED.</p> <p>If the PC modelled with BAT is >1% of the CLe/CLo an ECOLOGICAL IMPACT ASSESSMENT WILL BE REQUIRED. See section 3 of this guidance.</p>

TABLE 3: ASSESSMENT OF PROJECT IN COMBINATION			
Assessment Stage	Consideration	Contextual information	Next steps
Step 8: Best Available Technology (BAT) measures	Undertake modelling of the PC including Best Available Techniques (BAT) to reduce ammonia emissions.	<p>Modelling must be undertaken by a suitably experienced and qualified air quality modeller.</p> <p>The model used must be fit for purpose, based on established science and be validated and independently reviewed.</p> <p>Measures to reduce ammonia emissions from intensive livestock units are detailed in 'Commission Implementing Decision (EU) 2017/302 of 15 February 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the intensive rearing of poultry or pigs' available at:</p> <ul style="list-style-type: none"> - https://publications.europa.eu/en/publication-detail/-/publication/968ab1da-f807-11e6-8a35-01aa75ed71a1/language-en <p>NRW has information about BAT measures used to reduce ammonia emissions:</p> <ul style="list-style-type: none"> - Natural Resources Wales / Reducing ammonia emissions from agriculture <p>Information about ammonia scrubber design and use can be found on the NRW website:</p> <ul style="list-style-type: none"> - Natural Resources Wales / Ammonia scrubber design and use 	<p>If the PC modelled with BAT shows that ammonia concentration and nitrogen deposition is reduced by more than or equal to the PC the proposal is considered unlikely to have a significant effect on designated sites as a result of ammonia emissions and NO FURTHER ASSESSMENT IS REQUIRED.</p> <p>If the PC modelled with BAT does not show that ammonia concentration and nitrogen deposition will be reduced by more than or equal to the PC, proceed to Step 9.</p>
Step 9: Screening project in-combination	Analyse the Sum of PCs against ammonia critical levels and nitrogen critical loads for each site screened in for consideration.	The ammonia critical level and nitrogen critical load for each sensitive receptor and background levels for the locality can be obtained from one or more of the following sources:	<p>If the Sum of PCs is >1% of CLe/CLo proceed to Step 10.</p> <p>If the Sum of PCs is <1% of CLe/CLo the proposal is considered unlikely to have a</p>

		<ul style="list-style-type: none"> - Site Relevant Critical Loads and Source Attribution Air Pollution Information System (apis.ac.uk) <p>For Ramsar sites, the CLo/CLe should be obtained based upon the habitat type(s) the site is designated for.</p> <p>Sensitive receptors may be established from site citations:</p> <ul style="list-style-type: none"> - https://designatedsites.naturalengland.org.uk/SiteSearch.aspx 	significant effect on designated sites as a result of ammonia emissions and NO FURTHER ASSESSMENT IS REQUIRED.
Step 10: Exceedance check in-combination	Determine the background ammonia concentrations and nitrogen deposition rates and calculate the in-combination Predicted Environmental Concentration (Sum of Process Contributions + Background Ammonia concentrations / N deposition) at each site.	<p>Background ammonia concentrations and nitrogen deposition at the designated site(s) can be sourced from</p> <ul style="list-style-type: none"> - https://www.apis.ac.uk/app <p>Note that background levels of ammonia in Shropshire are already over most CLe and CLo for designated sites.</p>	<p>If the iPEC causes an exceedance of the CLe or CLo proceed to Step 11.</p> <p>If the iPEC does not cause an exceedance of the CLe or CLo, the proposal is considered unlikely to have a significant effect on designated sites as a result of ammonia emissions and NO FURTHER ASSESSMENT IS NORMALLY REQUIRED, however, there may be occasions where the background is close to the CLe/CLo and even if the proposal does not cause an exceedance of the CLe/ CLo, further consideration may be necessary.</p>
Step 11: Sum of PCs with BAT screen in-combination	Analyse the Sum of PCs including BAT against ammonia critical levels and nitrogen critical loads for each site screened in for consideration.		If the Sum of PCs modelled with BAT is <1% of CLe/CLo the proposal is considered unlikely to have a significant effect on designated sites as a result of ammonia emissions and NO

			<p>FURTHER ASSESSMENT IS REQUIRED.</p> <p>If the Sum of PCs modelled with BAT is >1% of the Cle/CLo an ECOLOGICAL IMPACT ASSESSMENT WILL BE REQUIRED. See section 3 of this guidance.</p>
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Screening assessment flowchart



3 ASSESSING THE SIGNIFICANCE OF ECOLOGICAL EFFECTS FROM IMPACTS OF AMMONIA ON DESIGNATED SITES.

- 3.1 Having utilised Tables 1 to 3 of this guidance document, this section provides applicants, their agents and, specifically, their ecological consultants, guidance on information to assist in the assessment of the significance of ecological effects on screened in sites.
- 3.2 An Ecological Impact Assessment is required to accompany a planning application for an intensive livestock unit where an exceedance of 1% of the ammonia critical level or nitrogen critical load (alone or in-combination with other plans or projects) remains even after the implementation of Best Available Technology, and therefore where air quality issues in relation to ecology cannot be dealt with as insignificant purely on modelled outputs.
- 3.3 There are a number of guidance documents to which applicants, their agents and consultants should refer when assessing the ecological effects of air quality on ecological sites which include the following:
- Advice on Ecological Assessment of Air Quality Impacts - Chartered Institute of Ecology and Environmental Management (2021)
 - Natural England Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final – Natural England (June 2018)
 - A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.1 - Holman *et al* (2020), Institute of Air Quality Management.
 - Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance. Natural England Commissioned Reports, Number 210 – Caporn *et al* (2016).
 - Air Quality, Design Manual for Roads and Bridges LA 105 Air Quality, Revision 0, Sustainability & Environment Appraisal - Highways Agency, (2019)
- 3.4 Detailed assessment allows a case-specific investigation of the likely impacts of ammonia emissions and nitrogen deposition from a proposed development, based on the best available information.
- 3.5 Following the analysis of air quality impacts together with the implementation of best available technology, a proposal would potentially be acceptable with regards to air quality impacts on designated sites if it can be demonstrated that the proposal:
- Will not have an adverse effect on the integrity of an international site, either alone or in combination with other projects or plans;
 - Will not have an adverse effect on an SSSI either individually or in combination with other developments; and
 - Will not cause the loss or deterioration of ancient woodland.

Additional mitigation measures

- 3.6 The use of other mitigation measures available to reduce ammonia emissions and / or reduce background levels can be considered as part of the Ecological Impact Assessment to demonstrate no adverse effects on designated sites, and the air quality

report would need to be updated, via an addendum to demonstrate how the quantum of mitigation proposed is justified.

- 3.7 If mitigation measures are considered necessary, they will need to satisfy the following tests, to allow them to be conditioned:
 1. Necessary;
 2. Relevant to planning;
 3. Relevant to the development to be permitted;
 4. Enforceable;
 5. Precise; and
 6. Reasonable in all other respects.
- 3.8 If mitigation measures are being proposed for an international site, an additional level of certainty needs to be applied, with evidence submitted by the applicant demonstrating that the mitigation measure(s) proposed is/are
 - a) Effective – the evidence underpinning the quantified reduction in ammonia concentration / nitrogen deposition must be scientifically robust and up to date.
 - b) Reliable - provide a high level of certainty as to the effectiveness of the mitigation measure(s) over the required duration.
 - c) Implementable – how the mitigation would be implemented and by whom.
 - d) Timely – the timescale of when it would implemented and over what duration it would be maintained and managed.
 - e) Guaranteed - how it would be reasonably monitored and enforced, and if the measure(s) failed, how the failure will be rectified by corrective measures.
- 3.9 Once the impact of the ammonia emissions from the proposed intensive livestock unit has been fully assessed, determination will be undertaken in the context of the appropriate legislation (for example Conservation of Habitats and Species Regulations 2017 (as amended) and national and local planning policy, particularly paragraph 180 of the National Planning Policy Framework 2021 and policy MD12 (Natural Environment) of the Site Allocations and Management of Development Plan 2016 – 2026 (SAMDev Plan).
- 3.10 Natural England, and where appropriate, Natural Resources Wales will be consulted on applications with the potential to affect international and national sites, and their views taken into account during the determination.

APPENDIX 1: USEFUL INFORMATION TO ASSIST IN COMPILATION OF AN ECOLOGICAL IMPACT ASSESSMENT FOR AMMONIA EMITTING PROPOSALS

The following information may be useful for the consultant ecologist to consider when compiling an EclA dealing with the effects of ammonia impacts.

Site condition monitoring

All European sites and SSSIs are surveyed by NE (or NRW in Wales) as part of the Habitats Directive Article 17 reporting or common standards monitoring. See <http://jncc.defra.gov.uk/page-2272> for general information on common standards monitoring. See <https://designatedsites.naturalengland.org.uk/SiteSearch.aspx> for condition monitoring of SSSIs. However, currently this monitoring is not designed to identify the specific effects of air pollution.

This information can still be used to inform a detailed assessment, for example the presence and location of sensitive habitats or species. However, even if the status of a feature is considered favourable it cannot be automatically assumed that there is no impact from the current emissions from the unit. Years may elapse before damage becomes detectable. Also, the effects from the ammonia emissions might be masked through the management of the SSSI, or they might not have been assessed.

Conservation objectives and detailed site management objectives

Conservation objectives are management objectives developed for each European site (Natura 2000 site) and each feature designated within that site. For European sites the conservation objectives can be found at <http://publications.naturalengland.org.uk/category/5134123047845888>. Further details on management objectives for EU sites are provided in the relevant Site Improvement Plan (SIP) at: <http://publications.naturalengland.org.uk/category/4879822899642368>,

(or Core Management Plans in Wales on the NRW Designated Sites Search webpages). The objectives will allow the protected habitat or species to be restored to, or maintained in 'favourable condition', which is the desired state of the species or habitat. The air pollution conservation objectives for all features are not fully completed. Seek advice from relevant NE or NRW specialists if needed.

For English SSSIs, additional information is provided in the Views About Management (VAMs) and for Welsh SSSIs in Site Management Statements (SMSs) explaining what is important and what management is required to help protect the site. For each SSSI a list of Operations Likely to Damage the Special Interest (OLDSI) has also been compiled. For these items see <https://designatedsites.naturalengland.org.uk/SiteSearch.aspx> website (or NRW Designated Site Search webpages).

It is important that the detailed assessment only considers the features sensitive to ammonia emissions and nitrogen deposition and their individual conservation objectives.

The detailed assessment must ensure that the conservation objectives for each relevant sensitive feature will not be compromised by the proposed livestock unit.

Site Improvement Plans

The Improvement Programme for England's Natura 2000 sites ran between 2013 and 2015 with the aim to have a shared understanding between Natural England, the Environment

Agency, and other key partners of what, how, where and when efforts can be targeted to improve the management of Natura 2000 sites and areas surrounding them.

As part of the programme for each international site (if designated as a SAC or SPA), a Site Improvement Plan (SIP) was compiled. The SIP outlines what is required to achieve and maintain sites in a good condition which may provide contextual information to inform the EclA.

<http://publications.naturalengland.org.uk/category/5458594975711232>

Distribution and condition of features within the designated site

As part of the screening process ILU a critical level (ammonia), and nitrogen critical load (nutrient enrichment and acidification) would have been applied to the conservation site based on the presence of sensitive features (lichen and bryophytes). However, no account will have been taken of the location of these features in relation to the pollution footprint from the unit.

The detailed assessment can be used to determine whether the sensitive features present at the nature conservation site fall within the pollution footprint of the unit. Pollution footprint isopleths should be included in the modelling submitted by the applicant.

In addition, site specific surveys may need to be carried out if limited or no site-specific information on the habitat types, or their extent or condition is available. The survey report must be submitted with the planning application for consideration by the LPA and where relevant, should include surveys for lichens and bryophytes to determine the correct CL to be used in the impact assessment. Guidance on the use of lichens to monitor air quality is available from: <https://www.apis.ac.uk/nitrogen-lichen-field-manual>

If it appears that there is no further readily available information on a sensitive receptor then, as a precautionary measure, assume that it occurs under the pollution footprint of the LSU.

Ellenberg values

Ellenberg indicator values have been produced for vegetation (ECOFACT Volume 2 <http://nora.nerc.ac.uk/id/eprint/6410/>) and for bryophytes (BRYOATT <https://www.brc.ac.uk/biblio/bryoatt-attributes-british-and-irish-mosses-liverworts-and-hornworts-spreadsheet>) in the British countryside. Bryoatt has also tabulated this information for many British bryophytes. Ellenberg scores can be used in a detailed assessment, where historical survey results are available for comparison, to determine whether:

- the nature conservation site has indicator species associated with nutrient enrichment or acidification;
- the lower plant or other species identified through survey are sensitive to the effects of ammonia.

Local environmental factors

Local factors, including environmental conditions and site management, are not always considered when setting critical loads. Where they are assigned as a range of values, the lowest end of the range is usually selected to ensure sufficient levels of protection.

However, local factors may modify the habitat or species sensitivity and response to a particular pollutant. For example, intensively managed heathland with frequent removal of vegetation may be less sensitive to nitrogen deposition due to the periodic removal of nutrients from the system. In such cases further consideration of which end of the critical load range may be more appropriate. APIS has provided additional information with indicative nitrogen critical loads to use for air pollution impact assessments.

Table 5 is indicative and not comprehensive, and not all factors will be relevant to all sites or all pollutants. It is not possible to quantify the effect these local factors have and to assign a new critical load on the basis of them. However, it may indicate that the higher or lower end of the critical load range is appropriate.

Table 4: Environmental factors and potential influence on habitats

Environmental Factor	Habitat type and influence
Precipitation	UK experts have provided guidance on how to apply the appropriate nitrogen critical load for raised and blanket bog habitats for air quality assessments. APIS has provided a grid reference tool to identify the rainfall range the bog habitat is located in.
Exposure	Woodland edges generally experience higher concentrations and deposition rates of pollutants and are therefore more vulnerable. This must be taken into consideration when assessing the unit's pollution footprint.
Water supply	When considering nutrient nitrogen (N) deposition for wet habitats, other sources of nutrient inputs, such as diffuse pollution, should be considered which may be more important. In these cases, the relative contribution from atmospheric and land based sources may need to be considered further to inform any judgements. Seek advice from NE specialists as to whether a critical level or critical load is appropriate for the European site or SSSI.
Soil phosphorous (P) status	High P availability increases sensitivity to N whilst low P availability may decrease the response to N. Note that some species such as lower plant communities may be sensitive to direct inputs of N regardless of P availability. For example, alkaline fens and reed beds have low P availability in their systems, which helps protect them from the effects of N eutrophication. They are characterised by species with base rich, nutrient poor characteristics.
Limiting nutrients in freshwater	Many river and lake freshwater systems are often P limited (or N/P co-limiting). However, a number of systems are N limited and in these cases atmospheric sources may be significant. This is most likely to occur in upland catchments where agricultural inputs are lower. Seek advice from NE specialists as to whether a critical level or critical load is appropriate for the European site or SSSI.

	<p>Critical level and critical load values are currently not provided for some standing waters or rivers. Critical levels and critical loads must be applied to any emergent vegetation or terrestrial feature that is within the designated site (e.g. floating water plantain is located on water surface and exposed to ammonia concentrations so the ammonia critical level would apply but not necessarily the nitrogen critical load because it is rooted under the water surface providing some protection.</p>
<p>Habitat management</p>	<p>Management regimes may obscure or modify some of the relationships between atmospheric deposition and habitat change.</p> <p>For example, intensive management of calcareous grassland can offset higher N inputs, to a certain extent, by removal through grazing, mowing or harvesting. Poor or infrequent management may increase vulnerability to N inputs.</p> <p>Consider whether there is active management of the nature conservation site in your detailed assessment and the level of commitment for its continuation in the future. If there is active management seek advice from NE specialists to determine which part of the nitrogen critical load range may be more appropriate to use. Are there any opportunities to provide wildlife site management in the long term as a mitigation measure?</p>

The exact nature and magnitude of these factors is not fully understood but it is important to take site-specific information into account where it is available.