

R.M & C.A BRIGHT
POULTRY UNITS AT GROES-Y-GARREG, BERRIEW, POWYS.
AMMONIA EMISSIONS ASSESSMENT: ADDENDUM

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1.0 INTRODUCTION

Isopleth Ltd has been commissioned by Berrys, on behalf of R.M & C.A Bright, to carry out a detailed assessment of ammonia impacts associated with a poultry operation at Groes-Y-Garreg, Berriew, Welshpool, Powys SY21 8AU. The farm lies within the administrative area of Powys Council.

1.1 Background

New poultry rearing (broiler) sheds are proposed on land adjacent to the farm. When complete, it is planned that the site capacity will increase to a maximum of 100,000 birds in 2 buildings.

An assessment of ammonia impacts against critical levels and critical loads (for nutrient nitrogen and acid deposition) was therefore been completed by Isopleth Ltd in May 2019 and reported at that time.

The type, source and significance of potential impacts were been identified and detailed modelling undertaken in line with NRW Guidance:

*NRW (December 2018) Assessing the impact of ammonia and nitrogen on designated sites from new and expanding intensive livestock units. Technical guidance for determining environmental permit applications or responding to planning application consultations. Reference number: **GN020***

Also:

*NRW (March 2017) Assessment of ammonia and nitrogen impacts from livestock units when applying for an Environmental Permit or Planning Permission. Reference number: **OGN 41***

Predicted ground level concentrations of ammonia, nutrient nitrogen and acid deposition were compared with relevant air quality standards and guidelines for the protection of sensitive habitats.

1.2 Requirement

Section 4.3 of the January 2019 report explained that:

'Powys Council has not yet been approached to identify other agricultural installations which, in their view, could potentially act in combination with the proposed development, such as:

- 1. Applications for planning or permitting that are submitted but not yet determined;*
- 2. Developments that have planning permission and/or permits but are not yet (fully) operating;*
- 3. Developments that started operating after the most recent update of background levels.'*

Indications at that time from Powys Council were that pre-application discussions would be required where such information would be provided.

Powys Council and Natural Resources Wales (NRW) have now requested this information and this report represents an addendum to the Isopleth Ltd January 2019 report, with this additional information presented.

1.3 Scope

The scope of this addendum is limited to providing the additional information requested by Powys Council and NRW in relation to in-combination impacts.

All of the model inputs for the Poultry units at Groes-Y-Garreg, in addition to meteorological data, topographical data etc. remain as presented in the Isopleth Ltd May 2019 report and have not been repeated in this addendum to that report.



2.0 SITE SETTING AND OPERATIONS

2.1 Description

The application description remains unchanged from the Isopleth Ltd May 2019 report.

The site is not currently developed and the applicant is now seeking to construct 2 houses for a total maximum capacity of 100,000 birds across the 2 sheds. The broilers will be brought in as day old chicks at a 50-50 mix of males and females. The 36 day growth period (with thinning at day 30) will lead to birds being around 2.0kg in weight by clearout.

2.2 Ecological Receptors

Ecological site searches 2km (local sites and AW) and 5km (SSSI and European sites) are included as Appendix B to the May 2019 report. These confirmed that the following sites are of interest:

- Montgomery Canal SAC and SSSI;
- Caeau Glyn SSSI;
- Coed Byrwydd SSSI;
- Glyn Wood LWS;
- Numerous ancient woodland sites.

Natural Resources Wales (NRW) have requested that the potential in-combination impacts on the Caeau Glyn SSSI and Coed Byrwydd SSSI are assessed, due to emissions from the following sources:

- Groes-Y-Garreg (proposed);
- Baseline (existing); and
- Other farms within 5km of the ecological receptors potentially impacted by Groes-y-Garreg.

Further assessment of impacts at the Montgomery Canal SAC and SSSI, LWS or AW's is not required. For another local scheme NRW has confirmed that '*The Montgomery Canal SAC does not need a nitrogen deposition assessment as it is not sensitive to it*'¹ hence there is no requirement to assess impacts at that SAC further.

¹ NRW ref: CAS-90979-S2B6, Planning Ref: P/2017/1509 MAJ, Date: 28/06/2019

3.0 APPROACH

3.1 General Approach

The general approach remains unchanged from the Isopleth Ltd May 2019 report.

3.2 Critical Levels

Critical levels for the protection of vegetation and ecosystems are specified within relevant European air quality directives and corresponding UK air quality regulations.

Table 3-1
Ammonia Critical Level

Concentration ($\mu\text{g}/\text{m}^3$)	Habitat and Averaging Period
1	Annual mean. Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity
3	For all higher plants (all other ecosystems)

NRW has confirmed that the critical level of $3 \mu\text{g}/\text{m}^3$ should be applied at the sites assessed in this report.

3.3 Critical Loads

Critical loads are set for the deposition of various substances to sensitive ecosystems. The AQTAG procedure defines the dispersion modelling approach in terms of receptor location and arrays, use of topographical and terrain data, the calculation of deposition fluxes, how these should be considered alongside the background conditions and relevant critical levels and loads.

Predicted contributions to acid deposition and nitrogen deposition have been calculated and compared with the relevant critical load range for the habitat types associated with each designated site as derived from the UK Air Pollution Information System (APIS) website². The contribution to critical loads for Nitrogen deposition are recorded as KgN/ha/yr. Deposition rates are converted to units of acid equivalents (k_{eq} /ha/year), which is a measure of how acidifying the chemical species can be, by dividing the dry deposition flux (kg/ha/year) by standard conversion factors.

Deposition rates were calculated using dispersion modelling results processed by following empirical methods recommended by the Environment Agency in AQTAG and summarised below.

² www.apis.ac.uk

Firstly, calculate dry deposition flux using the following equation:

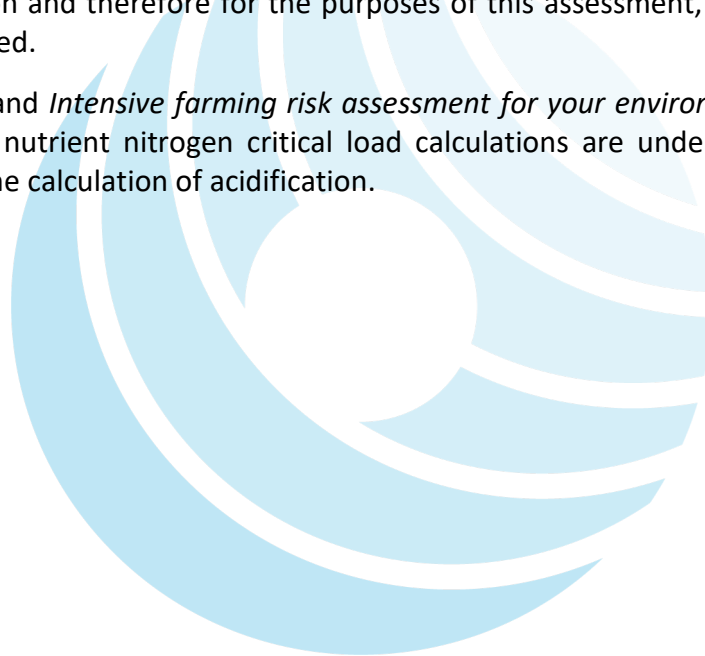
$$\text{Dry deposition flux } (\mu\text{g}/\text{m}^2/\text{s}) = \text{ground level concentration } (\mu\text{g}/\text{m}^3) \times \text{deposition velocity } (\text{m}/\text{s})$$

The applied deposition velocity for ammonia is 0.020 m/s for grassland and 0.030 m/s for woodland. This may be adapted based on the overall concentration of ammonia as a process contribution however this value is appropriate for concentrations below 10 $\mu\text{g}/\text{m}^3$. For sites such as water bodies, this deposition velocity may be reduced still further, with a value of 0.005 m/s having been applied (and accepted) for previous planning applications within Powys.

The units are then converted from $\mu\text{g}/\text{m}^2/\text{s}$ to units of kg/ha/year by multiplying the dry deposition flux by a standard conversion factor for ammonia of 259.7.

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 compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered.

GN 020, OGN 41 and *Intensive farming risk assessment for your environmental permit* only requires that the nutrient nitrogen critical load calculations are undertaken. There is no requirement for the calculation of acidification.



4.0 ASSESSMENT

As with the May 2019 report, modelling has been completed in line with the requirements of Guidance on modelling the concentration and deposition of ammonia emitted from intensive farming. Air Quality Modelling and Assessment Unit, 22 November 2010, v3. The BREEZE AERMOD model has been used.

4.1 Receptors

Modelling was carried out with discrete receptors representing the ecological sites of biological interest. Impacts at the same 12 receptors that were used in the May 2019 assessment have been used for this addendum.

Table 4-1
Ecological Receptor Locations

Receptor	Site	OS Coordinate Xm	OS Coordinate Ym	Height (m AoD)
ER1	Caeau Glyn SSSI 1	317836.0	302809.0	152.5
ER2	Caeau Glyn SSSI 2	317959.0	302907.0	143.9
ER3	Caeau Glyn SSSI 3	317963.0	303043.0	163.2
ER4	Caeau Glyn SSSI 4	317899.0	303134.0	158.2
ER5	Coed Byrwydd SSSI 1	315942.0	303975.0	239.9
ER6	Coed Byrwydd SSSI 2	316090.0	304032.0	231.7
ER7	Coed Byrwydd SSSI 3	316138.0	304051.0	226.9
ER8	Coed Byrwydd SSSI 4	316246.0	304085.0	225.1
ER9	Coed Byrwydd SSSI 5	316305.0	304085.0	229.0
ER10	Coed Byrwydd SSSI 6	316365.0	304179.0	227.5
ER11	Coed Byrwydd SSSI 7	316417.0	304287.0	203.7
ER12	Coed Byrwydd SSSI 8	316499.0	304334.0	194.5

4.2 Model inputs

A single scenario has been run to reflect the proposed scheme.

In addition, a single scenario has been run with the in-combination sites shown in table 4-2. All of the sources have been modelled, with:

- a steady state emission across all modelled hours from a single point at the centroid of each farm;
- no buildings included, however a stack release height of 1m and efflux velocity of 1m/s to represent potential downwash effects;
- stack temperature 15°C and diameter of 1m;
- maximum livestock capacity as detailed on the planning portal information; and

- SCAIL ammonia emission rates.

It is recognised that the above assumptions represent a simplification of the in-combination sites, however in the absence of any detailed information in the public domain or any information supplied by Powys Council or NRW it represents the most appropriate approach in this case. Powys Council or NRW must not rely on any of the model inputs or in-combination impacts as suitable for use for any other purpose than this indicative assessment.

Table 4-2
In-Combination Sites

Site Ref	App Number	Postcode	OS Coordinate Ym	OS Coordinate Xm
CF1	P/2018/0219	SY21 0DG	310931	304233
CF2	p/2017/1509	SY21 8AT	317096	303036
CF3	P/2017/1346	SY21 8NH	322266	301805
CF4	P/2016/0755	SY21 8QH	315727	298903
CF5	P/2018/0313	SY21 9HD	312151	306145
CF6	P/2016/0540	SY22 6YG	314138	309273

In relation to the Groes-Y-garreg site, A single scenario has been modelled. This represents the proposed broiler facility with 100,000 birds housed in 4 buildings.

The presence of elevated terrain can significantly affect ground level concentrations of pollutants emitted from sources 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.

The site is located at approximately 201m AOD. Information relating to the topography of the area surrounding the site has been used to assess the impact of terrain features on the dispersion of emissions from the site. Topographical data has been obtained in digital (.ntf) format and incorporated into the assessment. Buildings have been incorporated into the dispersion model as detailed in the modelling files at a height of 3.728m (the average of eaves to ridge). This compares with the 4.53m stack heights modelled and gable fans for the which have been modelled as area sources (with no vertical velocity).

The emissions of ammonia from the poultry buildings have been calculated using the Environment Agency / NRW ammonia emission factors. These are indicative only and may not reflect actual emissions where housing methods exceed minimum requirements and ammonia emissions are therefore lower than those which may be found at a 'standard' facility. Indirect heating is used for the new broiler houses (ground source heat pumps) and a >35% reduction has been applied to ammonia emissions from the site.

The ammonia emitted from the farm with the standard EA factor of 0.034 kg NH₃/animal place/year (reduced to 0.0221 kg NH₃/animal place/year due to the ground source heat pumps) are as shown in Table 4-2. Each of the buildings has been assumed to house 50000

birds (i.e. even distribution at the maximum capacity) which is a worst case assumption as mortality throughout the crop will mean that fewer birds are in the final crop. The gable-end fans would be used rarely, if at all. However, for purposes of this assessment, 25% of the ammonia is assumed to be emitted from these fans in order to represent a worst-case approach for this modelling which relies on annual average impacts.

Table 4-3
Emission Rates (g/s)

Receptor	Emission
House 1 (proposed)	0.001877 g/s per fan 0.00876 g/m ² /s (gable)
House 2 (proposed)	0.001877 g/s per fan 0.00876 g/m ² /s (gable)

The (standard) emission parameters per stack are as shown in Table 4-3 below for all stacks modelled.

Table 4-4
Emission Parameters

Stack height (m)	Temp (°C)	Velocity (m/s)	Stack Diameter (m)
4.53	25	3.0	0.8

The gable end fans have been modelled as area sources the width of the house (and 3m deep) at a release height of 2m above ground level.

Although many of the in-combination farms are free range, as a worst case (indicative) assumption 100% of the emitted ammonia is assumed to be via the point source. The total ammonia emission for the in-combination sites is shown below. In each case, the total ammonia emission rate has been taken from the ammonia assessment submitted with the planning application for that site.

Table 4-5
In-Combination sites: Emission Rates (g/s)

Receptor	Max Number of Birds	Total Emission (g/s NH ₃)	Data Source
CF1	16000	0.01776	SCAIL
CF2	8000	0.02821	ADMS Model
CF3	32000	0.03551	SCAIL
CF4	16000	0.06025	SCAIL
CF5	38000	0.04820	ADMS Model
CF6	16000	0.08245	ADMS Model

4.3 Results: Critical Levels

4.3.1 Process Contribution (Groes-y-Garreg)

The dispersion modelling results are shown in the tables below.

Table 4-6
PC Results: Critical Levels

Site	NH ₃ Concentration (µg/m ³)	% of Critical Level 3 µg/m ³
Caeau Glyn SSSI 1	0.331	11.0%
Caeau Glyn SSSI 2	0.256	8.5%
Caeau Glyn SSSI 3	0.234	7.8%
Caeau Glyn SSSI 4	0.233	7.8%
Coed Byrwydd SSSI 1	0.005	0.2%
Coed Byrwydd SSSI 2	0.009	0.3%
Coed Byrwydd SSSI 3	0.014	0.5%
Coed Byrwydd SSSI 4	0.019	0.6%
Coed Byrwydd SSSI 5	0.014	0.5%
Coed Byrwydd SSSI 6	0.016	0.5%
Coed Byrwydd SSSI 7	0.037	1.2%
Coed Byrwydd SSSI 8	0.035	1.2%

The results are as follows:

- The highest PC impact at the Caeau Glyn SSSI is greater than 8%; and
- The highest PC impact at the Coed Byrwydd SSSI is between 1 and 8%.

4.3.2 In-Combination Impacts

The in-combination dispersion modelling results against critical levels are shown in the tables below. As described above, these must be regarded as indicative as they are based on the availability information for each site.

Table 4-7
In Combination PC Results: Critical Levels

Site	NH ₃ Concentration (µg/m ³)	% of Critical Level 3 µg/m ³
Caeau Glyn SSSI 1	0.076	2.5%
Caeau Glyn SSSI 2	0.083	2.8%
Caeau Glyn SSSI 3	0.093	3.1%
Caeau Glyn SSSI 4	0.103	3.4%
Coed Byrwydd SSSI 1	0.024	0.8%
Coed Byrwydd SSSI 2	0.031	1.0%
Coed Byrwydd SSSI 3	0.034	1.1%

Site	NH ₃ Concentration (µg/m ³)	% of Critical Level 3 µg/m ³
Coed Byrwydd SSSI 4	0.034	1.1%
Coed Byrwydd SSSI 5	0.033	1.1%
Coed Byrwydd SSSI 6	0.033	1.1%
Coed Byrwydd SSSI 7	0.036	1.2%
Coed Byrwydd SSSI 8	0.036	1.2%

The results are as follows for the in-combination sites:

- The highest PC impact at the Caeau Glyn SSSI is between 1 and 8%
- The highest PC impact at the Coed Byrwydd SSSI is between 1 and 8%.

4.3.3 Predicted Environmental Concentration

Although in reality is likely that some of the modelled in-combination sites are already encompassed within the existing APIS background (based on data up to the end of 2017), it is possible to calculate the PEC through addition of the Groes-y-Garreg impacts (existing and proposed) with the in-combination sites and the APIS background, given as 1.7 µg/m³ at this location.

The PEC (Groes-y-Garreg, in-combination and background) has been compared against critical levels and this is shown in the table below.

Table 4-8
PEC Results: Critical Levels

Site	NH ₃ Concentration (µg/m ³)	% of Critical Level 3 µg/m ³
Caeau Glyn SSSI 1	2.107	70.2%
Caeau Glyn SSSI 2	2.040	68.0%
Caeau Glyn SSSI 3	2.028	67.6%
Caeau Glyn SSSI 4	2.036	67.9%
Coed Byrwydd SSSI 1	1.729	57.6%
Coed Byrwydd SSSI 2	1.739	58.0%
Coed Byrwydd SSSI 3	1.748	58.3%
Coed Byrwydd SSSI 4	1.753	58.4%
Coed Byrwydd SSSI 5	1.747	58.2%
Coed Byrwydd SSSI 6	1.748	58.3%
Coed Byrwydd SSSI 7	1.773	59.1%
Coed Byrwydd SSSI 8	1.771	59.0%

The PEC impacts are predicted to be below the critical level of 3µg/m³, with the impact dominated by the existing background at both SSSI.

4.4 Results: N Nitrogen Critical Load

4.4.1 Process Contribution (Groes-y-Garreg)

The dispersion modelling results against nutrient nitrogen critical load are shown in the tables below.

Table 4-9
PC Results: N Critical Loads

Site	Conc ($\mu\text{g}/\text{m}^3$)	N Dep kg/ha/yr	% of Lower C.L.	% of Upper C.L.
ER1	0.331	1.72	8.59%	5.73%
ER2	0.256	1.33	6.67%	4.45%
ER3	0.234	1.22	6.10%	4.06%
ER4	0.233	1.21	6.05%	4.03%
ER5	0.005	0.04	0.26%	0.20%
ER6	0.009	0.07	0.46%	0.35%
ER7	0.014	0.11	0.75%	0.56%
ER8	0.019	0.15	1.00%	0.75%
ER9	0.014	0.11	0.75%	0.56%
ER10	0.016	0.12	0.81%	0.61%
ER11	0.037	0.29	1.91%	1.43%
ER12	0.035	0.27	1.82%	1.37%

NRW has confirmed that the relevant critical loads are:

- Caeau Glyn SSSI: Low and medium altitude hay meadows 20 - 30 Kg N/ha/year;
- Coed Byrwydd SSSI: Meso- and eutrophic Quercus woodland 15 - 20 Kg N/ha/year;

The results are as follows:

- The highest PC impact at the Caeau Glyn SSSI is between 1% and 8% of the upper critical load; and
- The highest PC impact at the Coed Byrwydd SSSI is between 1% and 8% of the upper and lower critical load.

4.4.2 In-Combination Impacts

The in-combination impacts dispersion modelling results against N critical loads are shown in the tables below. As described above, these must be regarded as indicative as they are based on the availability information for each site.

Table 4-10
In Combination PC Results: N Critical Loads

Site	Conc ($\mu\text{g}/\text{m}^3$)	N Dep kg/ha/yr	% of Lower C.L.	% of Upper C.L.
ER1	0.076	0.40	1.99%	1.32%
ER2	0.083	0.43	2.17%	1.44%
ER3	0.093	0.49	2.43%	1.62%
ER4	0.103	0.54	2.68%	1.79%
ER5	0.024	0.19	1.26%	0.95%
ER6	0.031	0.24	1.59%	1.19%
ER7	0.034	0.26	1.74%	1.31%
ER8	0.034	0.26	1.76%	1.32%
ER9	0.033	0.25	1.69%	1.27%
ER10	0.033	0.25	1.70%	1.27%
ER11	0.036	0.28	1.89%	1.42%
ER12	0.036	0.28	1.88%	1.41%

The results are as follows for the in-combination sites:

- The highest PC impact at the Caeau Glyn SSSI is between 1% and 8% of the upper and lower critical load; and
- The highest PC impact at the Coed Byrwydd SSSI is between 1% and 8% of the upper and lower critical load.

4.4.3 Predicted Environmental Concentration

APIS indicates that the ammonia background N deposition at the site (OS GR 317125, 302730) is:

- Woodland: 28.28 Kg N/ha/year; and
- Grassland: 17.08 Kg N/ha/year.

The background N deposition for woodland of 28.28 Kg N/ha/year is therefore above the upper and lower N critical load at the Coed Byrwydd SSSI of 15 - 20 Kg N/ha/year (for Meso- and eutrophic Quercus woodland).

The background N deposition for grassland of 17.08 Kg N/ha/year is therefore below the upper and lower N critical load at the Caeau Glyn SSSI of 20 - 30 Kg N/ha/year (for Low and medium altitude hay meadows).

The PEC (Groes-y-Garreg, in-combination and background) for each of the 12 discrete receptors are presented below:

Table 4-11
PEC Results: N Critical Loads

Site	In-comb N Dep kg/ha/yr	PEC N Dep kg/ha/yr	% of Lower C.L.	% of Upper C.L.
ER1	2.12	19.20	96.0%	64.0%
ER2	1.77	18.85	94.2%	62.8%
ER3	1.70	18.78	93.9%	62.6%
ER4	1.75	18.83	94.1%	62.8%
ER5	0.23	28.51	190.1%	142.5%
ER6	0.31	28.59	190.6%	142.9%
ER7	0.37	28.65	191.0%	143.3%
ER8	0.41	28.69	191.3%	143.5%
ER9	0.37	28.65	191.0%	143.2%
ER10	0.38	28.66	191.0%	143.3%
ER11	0.57	28.85	192.3%	144.2%
ER12	0.56	28.84	192.2%	144.2%

Impacts from the farm, in-combination and background sources are below the critical loads at the Caeau Glyn SSSI, but above critical loads at the Coed Byrwydd SSSI. This contribution is dominated by the existing background.

5.0 CONCLUSIONS

The potential ammonia impacts of an expansion to Groes-y-Garreg on local ecological sites was assessed and reported in May 2019. NRW has requested an assessment of in-combination impacts from other sites within 5km of the Caeau Glyn SSSI and Coed Byrwydd SSSI and this addendum provides the results of this.

The applicant is seeking to construct 2 houses for a total maximum capacity of 100,000 birds across the 2 sheds. The farm will use indirect heating which has been demonstrated to reduce ammonia emissions.

An assessment of ammonia impacts against critical levels and critical loads (for nutrient nitrogen) has been completed in accordance with Powys and NRW Guidance. Predicted ground level concentrations of ammonia and nutrient nitrogen are compared with relevant air quality standards and guidelines for the protection of sensitive habitats.

The January 2019 assessment indicated that:

- No further assessment is required in relation to ammonia impacts against critical levels;
- The existing nutrient nitrogen deposition is above the limit at the Coed Byrwydd SSSI; and
- Although the N deposition process contributions are well below the limit, the high background (in common with the majority of the UK) means that further mitigation may be required.

Notice:

This report was produced by Isopleth Ltd to present the results of an ammonia impact assessment for the proposed development on land at Groes-y-Garreg.

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Isopleth Ltd
Ulverston,
53 Englishcombe Lane,
Bath
BA2 2EE
www.isopleth.co.uk

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