Report

Hilltop Free Range Separation Distance Assessment

PSA Consulting

Job: 23-129

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1 INTRODUCTION

Astute Environmental Consulting Pty Ltd (Astute) was engaged by PSA Consulting to perform a Level 1 Odour Impact Assessment (separation distance study) relating to a proposed 30,000 bird free range layer operation ("the farm") at 1056 Lachlan Valley Way, Boorowa in New South Wales ("the site").

1.1 Understanding of the Project

The project will involve pasture-raised egg layer birds being stocked in a series of production areas spread across the site. A total of 30,000 birds will be held in up to 50 mobile caravans across 13 defined production areas. Each caravan can hold a maximum of 900 birds.

The site is shown in Figure 1-1 where the boundary of the lots associated with the farm are shown as blue polygons. The orange polygons show the various production areas. The location of these is based on plans provided to us by PSA Consulting.

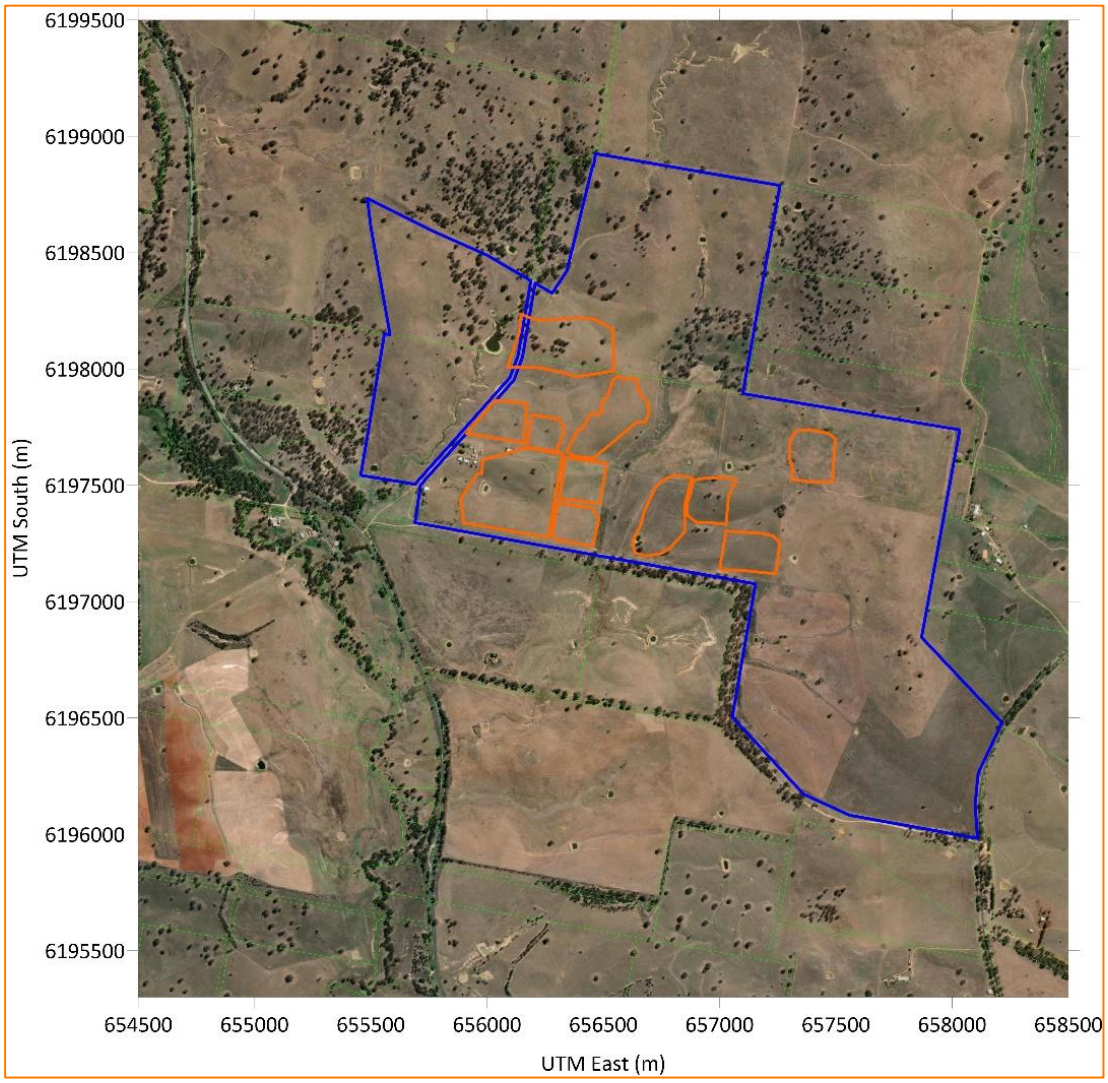

Figure 1-1: Site and Production Areas

1.2 Study Objective

The objective of this assessment is to determine the separation distances[1] for the farm in line with the Technical Notes: assessment and management of odour from stationary sources in NSW (DEC NSW, 2006)[2].

1.3 Scope of Work

The scope of work for the assessment included:

- Obtaining information about the proposed farm;
- Identifying sensitive locations[3];
- Reviewing terrain heights;
- Reviewing land use around the farm;
- Calculating evaluation distances for the farm; and
- Preparing a report.

[1] Commonly referred to as separation distances or buffer distances
[2] "the Technical Notes"
[3] Commonly referred to as sensitive receptors.

2 SEPARATION DISTANCES

When siting an odorous operation, the distance between the operation and nearby neighbours is critical to ensure that the risk of odour impacts is minimised. In New South Wales, a Level 1 assessment can be used to derive a separation distance between an operation and nearby sensitive locations.

The technical notes provide methodologies for broilers (meat chickens), feedlots and piggeries. Although the proposed operation is a layer farm, the broiler methodology can be conservatively adopted in that it is recognised that meat chicken farms emit more odour than layer farms (McGahan & Galvin, 2018).

The Level 1 methodology is commonly referred to as an S Factor method. The S Factor method in the technical notes uses an equation that includes the following inputs:

- Number of animals – N (for meat chickens N is the total number of birds divided by 22,000);
- Shed type (S1);
- Receptor type factor (S2);
- Terrain factor (S3);
- Vegetation Factor (S4); and
- Wind Frequency (S5).

Each of the S factors is input into Equation 1 where D is the required buffer in metres.

$$D = N^{0.71} \times S_1 \times S_2 \times S_3 \times S_4 \times S_5$$ **Equation 1**

It is noted that this method assumes that the distance is measured from the closest point of a poultry shed to the receptor. If the birds were spread across a larger area, assuming the birds were located at the closest point of the production area to the receptor would be conservative.

2.1 S1 Type of Farm

S1 is the type of farm. As layers farms don't fit within the meat chicken definitions, we have applied the factor for a naturally ventilated shed (S1=690).

This is considered conservative as the caravans can move and the bird can move around, and therefore manure doesn't accumulate like a naturally ventilated shed.

2.2 S2 Receptor type factor

Receptors (sensitive locations) in the area were identified using aerial photography.

The closest five receptors are shown in Figure 2-1 below. Each receptor is shown as a numbered yellow marker. Further information on each receptor is provided in Table 2-1 below.

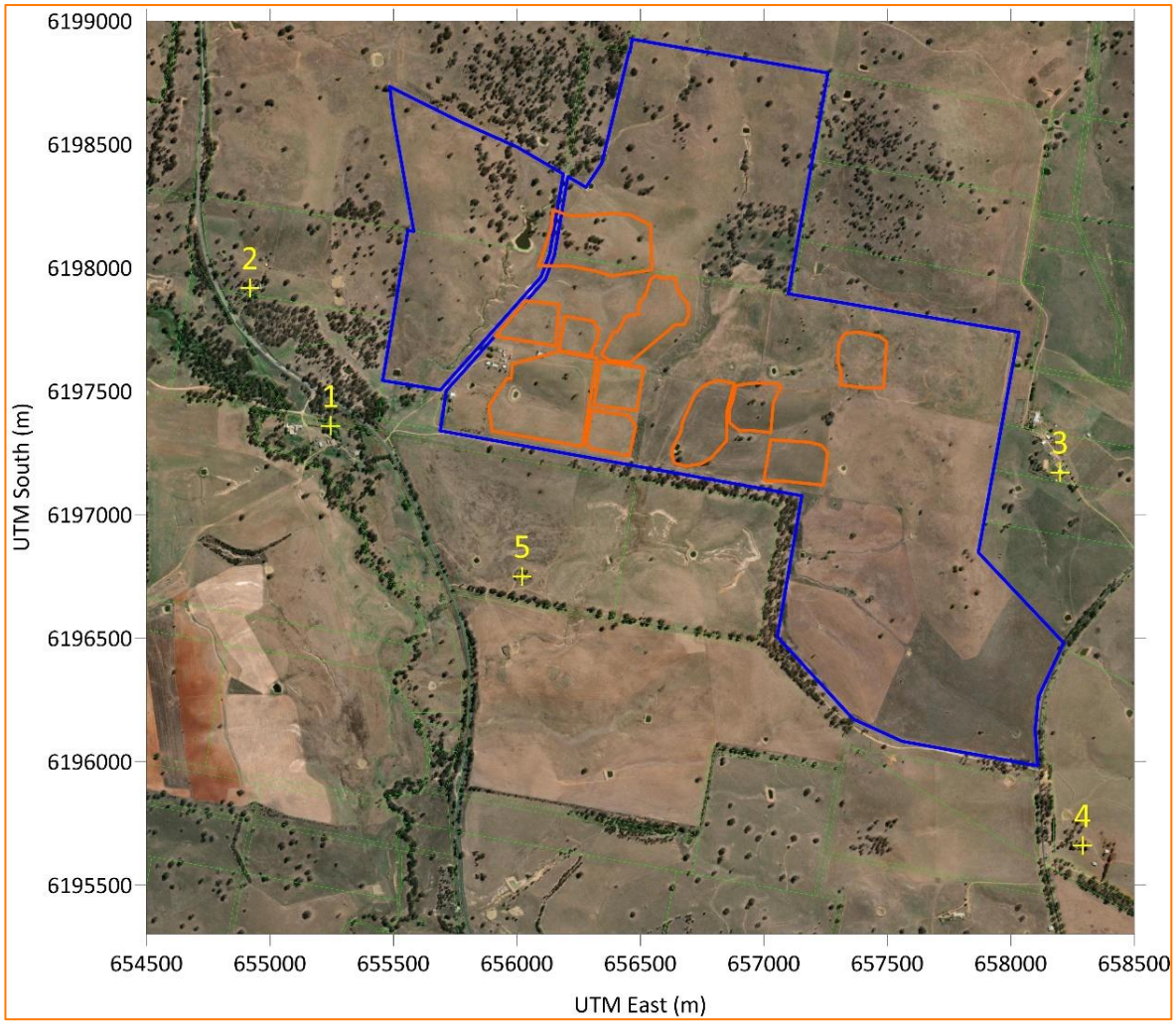

Figure 2-1: Site and Receptors

Distances to each receptor were derived by taking the x and y coordinates in metres at each receptor from a georeferenced image. The distance from the closest point of the farm complex (any of the production areas in Figure 2-1 above) to each receptor was then calculated using trigonometry.

The elevation at each receptor was taken from 1-metre Digital Elevation Model (DEM) data from Geoscience Australia's ELVIS (Elevation and Depth – Foundation Spatial Data) system. The DEM data was imported into QGIS, converted to a compatible coordinate reference system, and then imported into Golden Software Surfer as a grid file. The height at each receptor was then extracted from the dataset and was paired with the height of the nearest point of the closest production area. Small changes in this estimation would be unlikely to significantly alter the outcomes.

The 1 m terrain data is shown overlaid on an aerial image in Figure 2-3 below. For readability, only 5 m increments are shown.

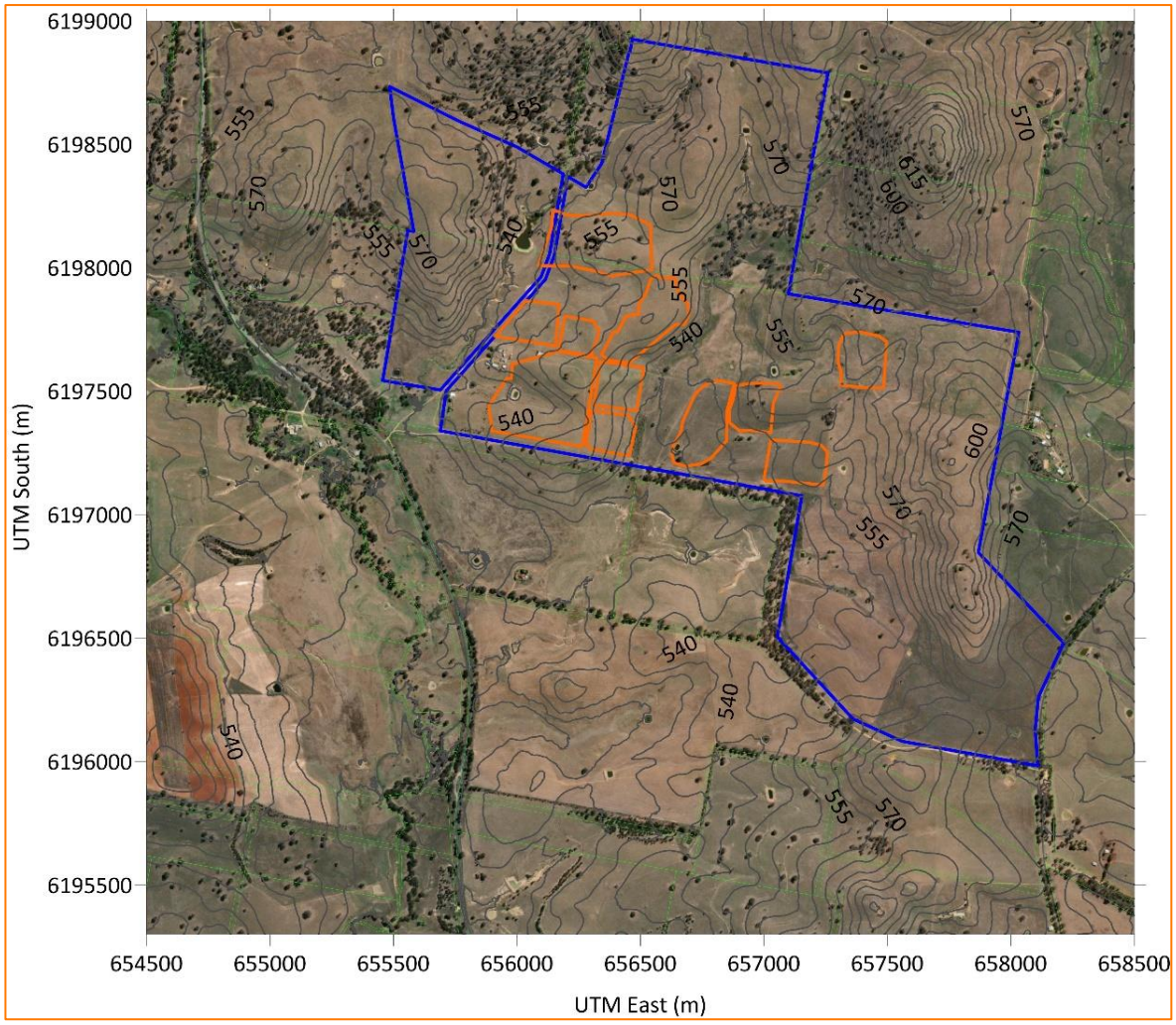

Figure 2-2: Site and DEM Contours

Table 2-1: Receptors, Distances and Height Difference

Receptor	Distance (m)	Receptor Height (m)	Range Area Height (m)	Height Difference (m)[4]	Slope (%)	Receptor Description
1	648	523	539	-15	-2.4%	House
2	1,013	548	537	12	1.1%	House
3	795	587	568	19	2.3%	House
4	1,799	558	548	10	0.5%	House
5	560	527	549	-22	-3.9%	House

The S2 factor (receptor type) was set to 0.3 as the receptors are single rural residences and do not fall into other categories, including small towns.

2.3 S3 Terrain Factor

The S3 factor is used to incorporate terrain into the assessment. The options detailed in the technical notes and their associated factors are summarised in Table 2-2 below.

Table 2-2: S3 Terrain Factors (DEC NSW, 2006)

Terrain	Factor
Valley Drainage	2.0
Low Relief	1.2
Flat	1.0
Undulating Country	0.9
High relief or significant hills and valleys	0.7

Based on the terrain data shown in Figure 2-2 above and by using the Google Earth Elevation Profile function, the terrain between the receptors and the site can be described as follows:

- R1 – falls away to the receptor;
- R2 – undulating and rises to the receptor;
- R3 – undulating and rises to the receptor;
- R4 – undulating and rises to the receptor; and
- R5 - falls away to the receptor.

The adopted S3 factors based on Table 2-2 above are summarised in Table 2-3 below.

[4] If the value is positive, the receptor is above the site, if negative, receptor is below the site. Distance is to nearest edge of a production area.

Table 2-3: Adopted S3 Factors

Receptor	Slope	Up/Down	Factor	Description
1	-2.4%	Down	1.2	Low relief
2	1.1%	Up	1.0	Flat
3	2.3%	Up	1.0	Flat
4	0.5%	Up	1.0	Flat
5	-3.9%	Down	1.2	Low relief

2.4 S4 Vegetation Factor

There are five options for vegetation factors in the method. As all of the receptors can be described as “few trees long grass”, an S4 factor of 0.9 was adopted.

2.5 S5 Wind Frequency

A “normal” value was adopted for the site (S5 = 1) as a site in an open area like this will not have a high or low frequency of winds (as defined by ±40°) toward the receptors. High or low frequencies are typically only seen in narrow valleys or areas where terrain can significantly channel winds.

2.6 Calculated Distances

The calculated distances for 30,000 birds are detailed in Table 2-4 below and are shown in Figure 2-3 below. Note that the separation distance from Table 2-4 is centred on each receptor. Using this method, if the farm production areas were within the circle, this would indicate an insufficient distance. This is not the case.

As a check, Table 2-5 below shows the separation distances for 60,000 birds (twice as many as being applied for). The site also complies for this scenario.

Table 2-4: Calculated Distances (30,000 birds)

Receptor	Available Distance (m)	S1	S2	S3	S4	S5	Required Distance	% of Available	Complies?
1	648	690.0	0.3	1.2	0.9	1.0	279	43%	Yes
2	1,013	690.0	0.3	1.0	0.9	1.0	232	23%	Yes
3	795	690.0	0.3	1.0	0.9	1.0	232	29%	Yes
4	1,799	690.0	0.3	1.0	0.9	1.0	232	13%	Yes
5	560	690.0	0.3	1.2	0.9	1.0	279	50%	Yes

Note: % of available is the required distance divided by available distance. For example, 70% would mean that the required distance is 70% of the available.

Table 2-5: Calculated Distances (60,000 birds)

Receptor	Available Distance (m)	S1	S2	S3	S4	S5	Required Distance	% of Available	Complies?
1	648	690.0	0.3	1.2	0.9	1.0	456	70%	Yes
2	1,013	690.0	0.3	1.0	0.9	1.0	380	37%	Yes
3	795	690.0	0.3	1.0	0.9	1.0	380	48%	Yes
4	1,799	690.0	0.3	1.0	0.9	1.0	380	21%	Yes
5	560	690.0	0.3	1.2	0.9	1.0	456	81%	Yes

Note: 60,000 birds is a sensitivity check only.

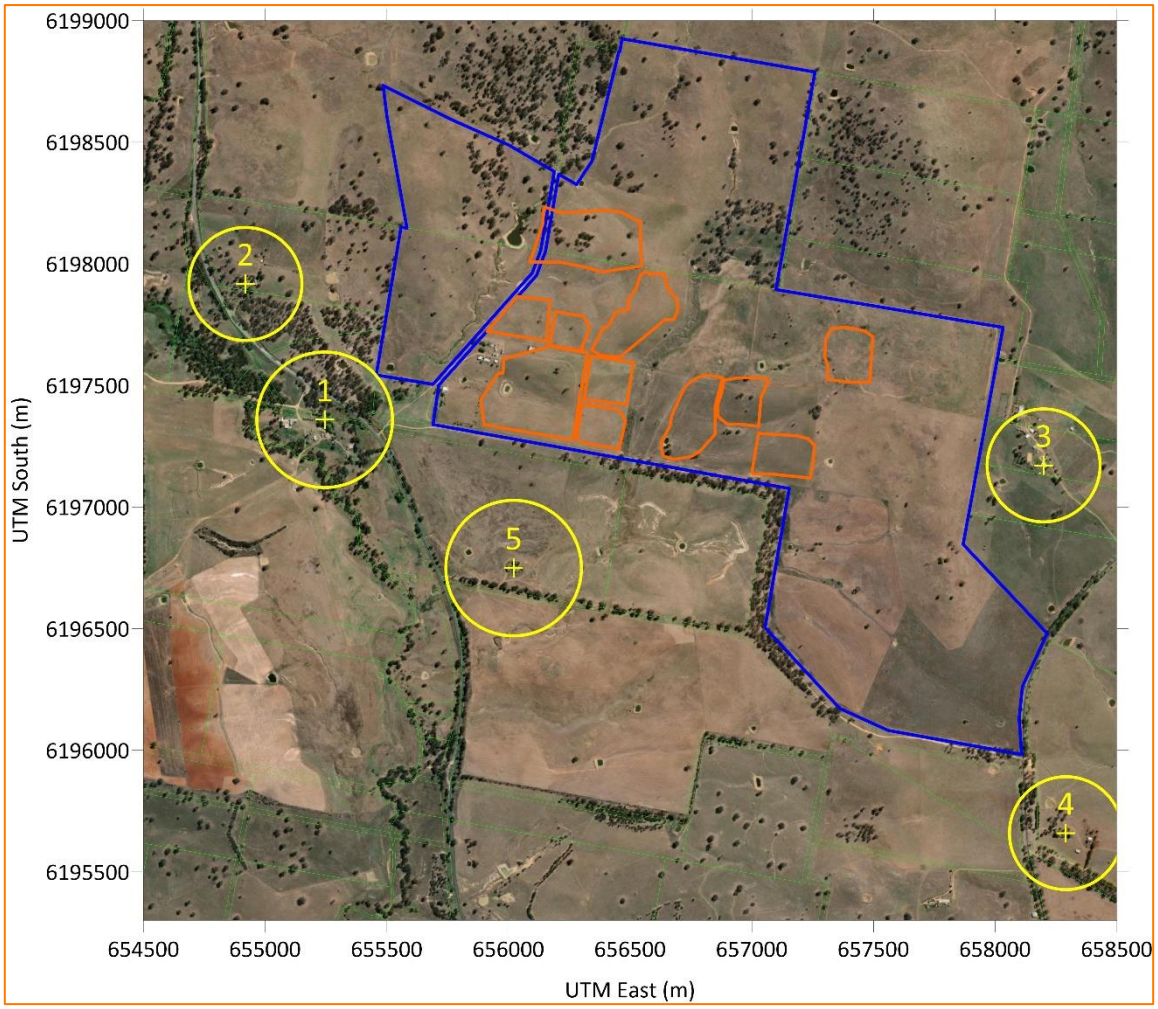

Figure 2-3: Site and Calculated Buffers (Yellow Circles)

3 DISCUSSION

The buffers calculated using the S Factor method for 30,000 birds and 60,000 birds (not applied for) were detailed in Table 2-4 and Table 2-5 respectively. Both showed compliance.

As noted above, the S Factor method above is for a meat chicken farm. The use of a meat chicken method for layers is considered conservative. Moreover, assuming a 30, 000 bird shed is on the closest point of the production area to each receptor is also conservative.

Although not within the technical notes, there is a layer industry-specific S Factor method in the Egg Industry Environmental Guidelines 2nd Edition (McGahan, et al., 2018). The method uses similar inputs which are placed into Equation 2 below where:

- N is the number of birds,
- S1 is the land use factor
- S2 is the surface roughness factor
- S3 is the terrain weighting factor; and
- S4 is the wind frequency factor (optional).

$$D = (\frac{N}{1000})^{0.63} \times S_1 \times S_2 \times S_3 \times S_4$$ **Equation 2**

Details of the factors available to use can be found in McGahan et al. (2018) and follow a format and decision process similar to that in DEC NSW (2006).

Buffers assuming 30,000 birds on site in a single shed on the closest boundary to each receptor were calculated using Equation 2 based on the data in Section 2 above. The calculated separation distances are summarised in Table 3-1 below and as with the S Factor method in DEC NSW (2006) demonstrate compliance.

Table 3-1: S Factor Method - Egg Industry Environmental Guidelines (30,000 birds)

Receptor	Available Distance (m)	S1	S2	S3	S4	Required Distance (m)	% of Availabl e	Complies?
1	648	20	1	1.2	1	205	32%	Yes
2	1,013	20	1	1	1	170	17%	Yes
3	795	20	1	1	1	170	21%	Yes
4	1,799	20	1	1	1	170	9%	Yes
5	560	20	1	1.2	1	205	37%	Yes

It is noted that McGahan et al. (2018) recommend adopting a 250 m minimum distance between a farm and a sensitive location if no local or state guidance documents exist. We note that if this 250 m distance were applied, the farm would also comply.

4 CONCLUSION

Separation distances have been calculated using the S Factor methodology in DEC NSW (2006) and also the S Factor Methodology in McGahan et al. (2018) based on site-specific values for the number of birds, farm type, vegetation, receptor type, terrain and vegetation types.

For the closest relevant receptors, compliance was predicted using both S Factor methods even when conservatively each receptor was assumed to have 30,000 birds condensed in a single location at the closest point to each receptor.

5 REFERENCES

DEC NSW, 2006. *Technical Notes: assessment and management of odour from stationary sources in NSW,* Sydney: Department of Environment and Conservation NSW.

McGahan, E. J. & Galvin, G., 2018. *Odour Review of Layer Farms and Development of S-Factor Formula,* North Sydney, NSW: Australian Eggs Ltd.

McGahan, E. J., Widemann, S. G. & Gould, N., 2018. *Egg Industry Environmental Guidelines 2nd Edition.* 2 ed. North Sydney: Australian Eggs Limited.