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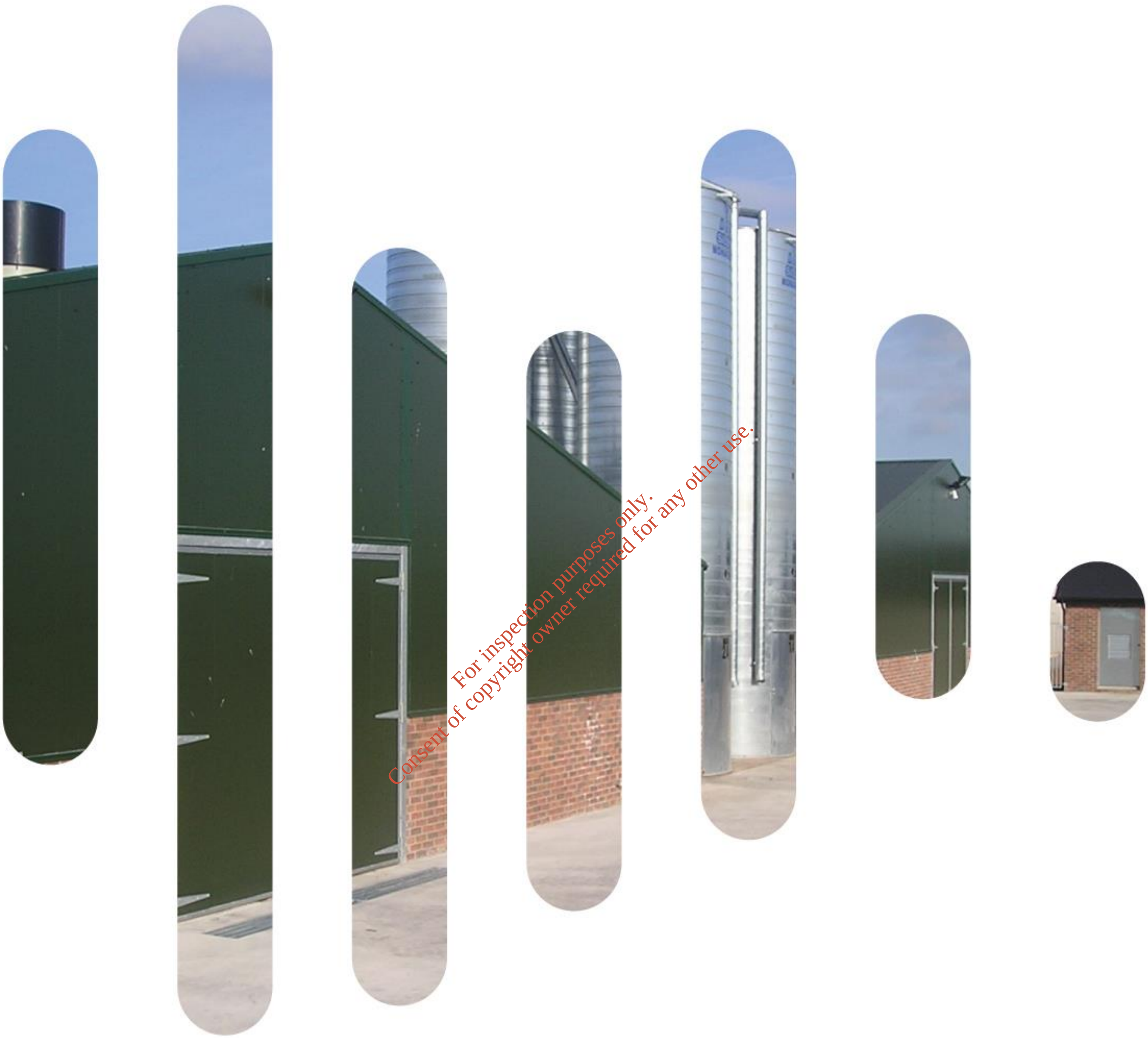

AIR QUALITY IMPACT ASSESSMENT
JORISTOWN PIGGERY

Rp002 2019182 (Joristown Piggery)
19 March 2021

PROJECT: AIR QUALITY IMPACT ASSESSMENT

PREPARED FOR: JORISTOWN PIGGERY
C/O CLW ENVIRONMENTAL PLANNERS
THE MEWS
23 FARNHAM STREET
CAVAN

ATTENTION: PARAIC FAY

REPORT NO.: Rp 002 2019182

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Document Control

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1 INTRODUCTION

Irwin Carr Ltd have been commissioned to undertake air quality dispersion modelling for an extension to an existing pig farm at Joristown Upper, Killucan, Co. Westmeath.

The purpose of this report is to quantify the odour levels at the sensitive properties in the vicinity of the pig farm.

The predicted impact can then be compared to an appropriate criterion and graphically illustrated in the form of 'contours of equal concentration' or isopleths which are superimposed on base maps.

1.1 Application Description

The site is currently made up of nine mechanically ventilated pig sheds, which house a total of 6,448 animals of varying size and type. As part of this assessment, four of the sheds, which house a total of 3,338 pigs are under consideration for the purposes of an EPA licence application. In order to accurately predict the odour impact from the site, all 9 sheds have been included as part of this assessment.

As part of this application, it is proposed to introduce mitigation to all nine sheds on the site. The applicant has confirmed that all of the sheds on the site were built, stocked and in operation in 2013 with no mitigation incorporated.

It is now proposed to incorporate a low protein diet on all nine sheds on-site, the associated reductions of which are included in Section 3.2.2 below. However, as part of this assessment a reduction as a result of the low protein diet has only been applied to the 4 fattener/ grower sheds (referred to as 'proposed' sheds for the purposes of this report).

The impact from the 5 'existing sheds' has been included in the model but does not account for the reductions associated with the low protein diet.

In addition to the low protein diet detailed above, additional mitigation is also incorporated into the 'proposed sheds' by way of the regular removal of slurry from the sheds. This slurry will be removed from the sheds in line with the Best Available Techniques (BAT) Reference Document and transported directly off site, so there will be no external storage of slurry on the site.

The reductions associated with this mitigation have also been included on the proposed sheds as part of this assessment.

2 ASSESSMENT CRITERIA

The proposed target levels and method of assessment is described in this section.

2.1 Odour

The Environmental Protection Agency provide guidelines for dispersion modelling as well as identifying target odour levels at the nearest sensitive locations in the vicinity of operations such as proposed pig and poultry sites.

Table 1 below shows how different types of processes are categorised and the appropriate odour benchmark values.

Table 1: Odour Benchmark levels

Relative Offensiveness of odour	Benchmark level (ou/s)
Most Offensive odours; • Processes involving decaying animals or fish • Processes involving septic effluent or sludge • Biological landfill odours	1.5
Moderately Offensive Odours • Intensive livestock rearing • Fat frying (food processing) • Sugar beet processing • Well aerated green waste composting	3.0
Less offensive odours; • Brewery • Confectionery • Coffee roasting • Bakery	6.0

Generally, odour concentrations should be below C98, 1-Hour 6ou$_E$/m^3 in order to prevent complaints arising from existing intensive pig facilities in Ireland.

For the purposes of assessing odorous emissions from the proposed extension to the intensive livestock rearing facility, and in the interests of conservatism, the odour target value of C98, 1-Hour ≤6 ou/m^3 will be adopted at the nearest sensitive receptor.

To put these guidelines into context, an odour threshold of 1ou/m^3 is the level at which an odour is detectable by 50% of screened panelists. The recognition threshold is about 5 times this concentration i.e. 5ou/m^3. Furthermore, odour concentration of between 5 and 10 ou/m^3 above background will give rise to a faint odour and concentrations greater than 10ou/m^3 constitutes a distinct odour and are likely to give rise to nuisance complaints.

Odour assessments are commonly compared to the 98th percentile of hourly averages. For a typical meteorological year the dispersion model predicts 8,760 hourly concentrations for each receptor location. The 98th percentile is part of the statistical distribution, where 98% of the results fall below this value and 2% of the results fall above this value.

3 AERMOD DISPERSION MODELLING DATA

The inputs for the dispersion modelling assessment are described in detail in this Section. A surface roughness factor of 0.2 has been used in the Aermod modelling process, and the results in this report reflect the use of this factor.

The site layout, including the nearest residential properties, is shown in Appendix A.

3.1 AERMOD Dispersion Modelling Package Description

The AMS.EPA Regulatory Model (AERMOD) is the current US EPA regulatory model used to predict pollutant concentrations from a wide range of sources that are present at typical industrial facilities.

The model accepts hourly meteorological data to define the conditions for plume rise, transport, diffusion and deposition. It estimates the concentration or deposition value for each source and receptor combination for each hour of input meteorology and calculates user-selected short term averages. The model also takes into account the local terrain surrounding the facility. Since most air quality standards are stipulated as averages or percentiles, AERMOD allows further analysis of the results for comparison purposes.

Percentile analysis for emissions is calculated for the maximum averages using the AERMOD-percent post-processing utility. This utility calculates the maximum concentration of a pollutant from all receptors at a specific percentile, for a specific period. Employing the percentile facilitates the omission of unusual short-term meteorological events that may cause elevated pollutant concentrations and hence a more accurate representation of the likely average pollutant concentrations over an averaging period.

The following information was input into the model for the prediction of maximum ground level ambient ammonia concentrations from the pig farm.

3.2 Input Parameters

The site layout map, building plans and elevations were used as a template for all sources, relevant structures and the boundary of the facility. The AERMOD package uses the steady state Gaussian plume equation for a continuous elevated point or line source.

Table 2 and 3 below gives general details of the existing and proposed pig houses respectively.

Table 2: Dimensions of Pig Houses (Breeding Yard)

	Shed 1 (Existing)	Shed 2 (Existing)	Shed 3 (Existing)	Shed 4 (Existing)	Shed 5 (Existing)
Dimensions of each house	70.2m x 12.5m x 4m	65.5m x 10.7m x 4m	27.2m x 10.8m x 4m	31.3m x 15.2m x 4m	66.3m x 16.7m x 4m
Total No. of Pigs	450 x Weaners, 146 x Farrowing	900 x Weaners, 110 x Farrowing	50 x Sows, 35 x Fatteners	1,100 x Weaners	319 x Sows
Efflux Temperature	20 °C	20 °C	20 °C	20 °C	20 °C
Emissions	Mechanically Ventilated	Mechanically Ventilated	Mechanically Ventilated	Mechanically Ventilated	Mechanically Ventilated

Table 3: Dimensions of Pig Houses (Finishing Yard)

	Shed 6 (Proposed)	Shed 7 (Proposed)	Shed 8 (Proposed)	Shed 9 (Proposed)
Dimensions of each house	79.24m x 13.7m x 4m	79.24m x 13.7m x 4m	60m x 13.7 x 4m	60m x 13.7 x 4m
Total No. of Pigs	580 x Fatteners 386 x Growers	573 x Fatteners 382 x Growers	429 x Fatteners 285 x Growers	422 x Fatteners 281 x Growers
Efflux Temperature	20 °C	20 °C	20 °C	20 °C
Emissions	Mechanically Ventilated	Mechanically Ventilated	Mechanically Ventilated	Mechanically Ventilated

It can be seen from the Table above that the proposed sheds include both fattener and grower pigs. A recent EU Commission Implementing Decision (CID)[1] defines production pigs, which will be housed on site, as,

> *'typically reared from a live weight of 30 kg to slaughter or first service. This category includes growers, finishers and gilts that have not been serviced.'*

This is evidence that production pigs also include grower pigs. Emission factors for grower pigs are provided in SCAIL and they are defined in BREF as ranging between 30-60kg[2].

It should be noted that not all animals on site will be at the maximum finishing weight prior to slaughter at the same time. When the sheds are fully stocked they operate on a continuous flow, rather than a batch type production system, thus at any one time there will be pigs in all the weight ranges the animals will range in weight between 30kg – market weight (c. 110-120 kg). It is expected that no more than 60% of the total animal numbers will be 'fatteners' (>60kg) at any time and therefore this assessment considers the worst case scenario of 60% fatteners and 40% growers."

3.2.1 EMISSIONS

The rate of production of an emission, such as odour, is best quantified as an emission rate.

To find the emissions from the house, it was necessary to calculate the concentration within the building. The Section below details the emission rates from the proposed sheds.

3.2.2 MITIGATION

The baseline emission factors for pigs have been outlined in Guidance published by the Environmental Protection Agency[3]. Chapter 9 of this Guidance document also details the basic principles for reducing odour emissions, namely:

- *Reduction of odourant formation in slurry: Reduction of the protein content in feed (Page 58, Section 9.2, Point 1c).*
- *Reduction of exposed area of slurry, including storage, soiled surfaces, grids etc: Frequent removal of slurry and storage in closed tanks (Page 59, Section 9.2, Point 3b)*

Both of these measures are recognised as Best Available Techniques (BAT) and are included in the BAT Reference Document as recommended reduction measures for both odour and ammonia.

It is also noted in Section 9.4.2 of the EPA Guidance, that,

> *"Low-emission housing systems have been developed, mainly with the objective to reduce ammonia emissions. Most systems will reduce odour emissions as well as ammonia emissions, roughly in equal measures."*

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[1] *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.*

[2] JRC Science for Policy Report. Best Available Techniques for the Intensive Rearing of Poultry and Pigs. Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control).

[3] *Odour Impacts and Odour Emission Control Measures for Intensive Agriculture. Final Report. Environmental Protection Agency 2001.*

A peer review report which has been prepared by Hayes et al[4] cites Kay and Lee[5] and details the ammonia reductions as a result of a low protein diet as:

> *'Reductions in ammonia emission equivalent to 9.8% per 10 g/kg reduction in dietary crude protein.'*

It has been confirmed that the pigs on site will be fed a diet with a crude protein level of 16%. As a result, an odour reduction of 30% has been applied to the sheds on site.

Table 5 below shows the category of animal and recommended emission factors per animal applicable to this project, based on the crude protein content of the feed of 16%, and the associated reduction.

The ammonia reductions associated with each measure are detailed in a additional report submitted as part of this application (Rp002 2019182- Joristown Pig Farm, Ammonia), with the corresponding odour reductions included in the Tables below.

Table 4 below details the emission factors associated with each animal type in a conventional shed, before the incorporation of a low protein diet.

Table 4: Odour Emission Factors accounting for Low Protein Diet

Category of Animal	Source Levels (ou/s/animal)	Low Protein Reduction	Levels after Reduction (ou/s/animal)
Sows/ Growers	19	30%	13.30
Fatteners	22.5		15.75

The emission factors included in the Table above have been corrected in the Table below to account for the regular removal of slurry, which will also be incorporated into the production pig houses only and will result in an odour reduction of 25%.

Table 5: Final Odour Emission Factors accounting for Regular Removal of Slurry

Category of Animal	Levels after Low Protein Diet (ou/s/animal)	Regular Removal of Slurry Reduction	Levels after Reduction (ou/s/animal)
Sows/ Growers	13.30	25%	**9.98**
Fatteners	15.75		**11.81**

Table 6 below details the total emission rates per shed, based on the emission factors calculated above.

In order to ensure a worst case scenario, the reduced emission levels have only been applied to the production sheds, with the standard emission factors (with no reductions applied) utilised for the sheds in the breeding yard.

[4] *Hayes, E.T., Leek, A.B.G., Curran, T.P., Dodd, V.A., Carton, O.T., Beattie, V.E. and O'Doherty, J.V. (2004). The influence of diet crude protein level on odour and ammonia emissions from finishing pig houses.* Bioresource Technology, *91: 309-315*

[5] *Kay R.M., and Lee, P.A. (1997). Ammonia emissions from pig buildings and characteristics of slurry produced by pigs offered low crude protein diets. In: Voermans JAM, Monteny GJ. Editors. Ammonia and odur emission from animal production facilities. Wageningen, The Netherlands; CIGR pg 253 – 259*

Table 6: Concentrations per Building

House No.	No. of Pigs	Odour Emission Factor (ou/s per animal)	Total Odour Emission Factor per Animal Type (ou/s)	Total Odour Emission Rate (ou/s per house)
E1	450 x Weaners	6	2,700	5,328
	146 x Farrowing	18	2,628	
E2	900 x Weaners	6	5,400	7,380
	110 x Farrowing	18	1,980	
E3	50 x Sows	19	950	1,737.5
	35 x Fatteners	22.5	787.5	
E4	1,100 x Weaners	6	6,600	6,600
E5	319 x Sows	19	6,061	6,061
P6	580 x Fatteners	11.81	6,851	10,702
	386 x Growers	9.98	3,850	
P7	573 x Fatteners	11.81	6,769	10,579
	382 x Growers	9.98	3,810	
P8	429 x Fatteners	11.81	5,068	7,910
	285 x Growers	9.98	2,843	
P9	422 x Fatteners	11.81	4,985	7,788
	281 x Growers	9.98	2,803	

The total emission rates are set as the pollutant leaving the building each second.

For the purposes of the modelling process, the emission rate per house was divided by the number of emissions points to obtain the emission value for each source.

Table 7 below shows the emission rates coming out of emission point.

Table 7: Emission Rates for each stack

House No.	No of Fans (and type)	Odour per fan (ou/s)
E1	9 x Ridge A 3 x Ridge B	444
E2	8 x Ridge A 2 x Ridge B	738
E3	2 x Ridge A	706
E4	5 x Ridge A	1,320
E5	4 x Ridge A	1,515
P6	11 x Ridge A	973
P7	11 x Ridge A	962
P8	8 x Ridge A	989
P9	8 x Ridge A	973

3.2.3 STACK EMISSIONS VELOCITY

There are two type of fans on the site, Table 8 below shows the ventilation rates for the chosen fan types.

Table 8: Ventilation Rates for fan

Fan Type	Stack Diameter (m)	Cross Sectional Area (m^2)	Exit Velocity (m/s)	Volume Flow (m^3/s)
Ridge A (DA 600 LPC-11)*	0.6	0.283	11.79	3.3
Ridge B	0.45	0.159	15.71	2.5

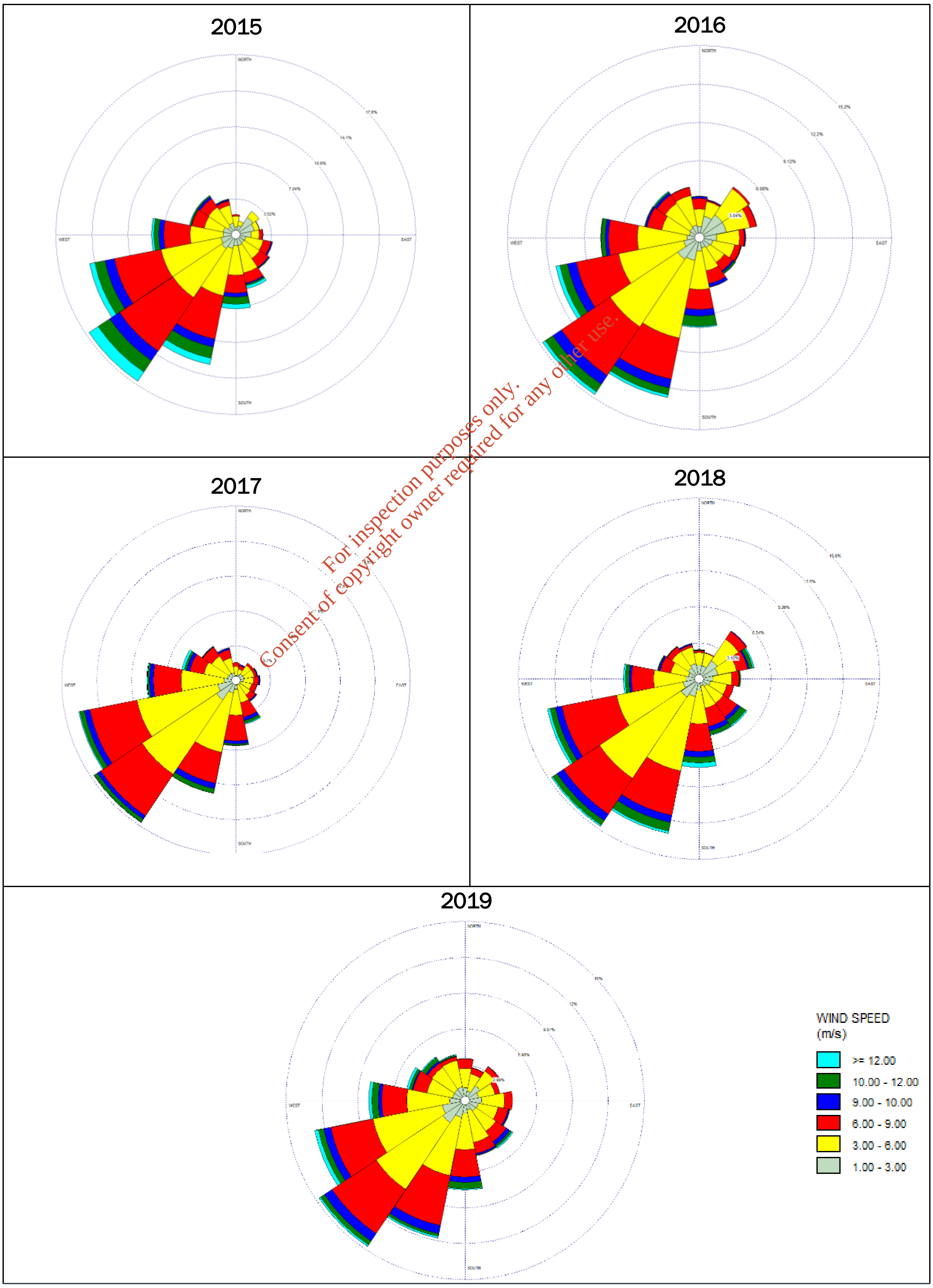
**The technical specification of this fan is provided in Appendix C.*

3.3 Meteorological Data

Five years of hourly sequential meteorological data was used for the AERMOD dispersion modelling assessment. The closest weather station to the proposed site can be identified on Figure 6.1 of the EPA's AG4 Guidance Note as Mullingar. However, it is noted that the annual mean wind speed at this location is 4.3m/s, which is within 1m/s of the annual wind speed at Ballyhaise (3.3m/s).

Given that the Ballyhaise weather station is within 1m/s of the Mullingar station, it was seemed representative of the average wind in the vicinity of the site. This allowed for the determination of the predicted overall average impact of emissions from the facility. The windrose data for each individual year is presented in Figure 1 below.

Figure 1: Annual Windrose Data- Ballyhaise



3.4 Building Downwash

When one or more buildings in the vicinity of a point source interrupt wind flow, an area of turbulence known as a building wake is created. Pollutants emitted from a relatively low level can be caught in this turbulence, affecting their dispersion. This phenomenon is called building downwash. In order to conduct an analysis of downwash effects of the point sources created to mimic the release of odorous air from the pig farm, the dimensions (including heights) of the proposed pig house and other existing buildings on-site was obtained from drawings.

3.5 Digital Terrain Data

AERMOD contains a terrain data pre-processor called AERMAP. Receptor and source elevation data from AERMAP output is formatted for direct insertion into an AERMOD control file. The elevation data are used by AERMOD when calculating air pollutant concentrations.

Regulatory dispersion models applicable for simple to complex terrain situations require information about the surrounding terrain. With the assumption that terrain will affect air quality concentrations at individual receptors, AERMAP first determines the base elevation at each receptor and source. For complex terrain situations, AERMOD captures the essential physics of dispersion in complex terrain and therefore needs elevation data that convey the features of the surrounding terrain. In response to this need, AERMAP searches for the terrain height and location that has the greatest influence on dispersion for each individual receptor. This height is the referred to as the hill height scale. Both the base elevation and hill height scale data are produced by AERMAP as a file or files which can be directly inserted into an AERMOD input control file.

4 RESULTS

There are ten third party residential properties in the immediate vicinity of the pig sheds.

A brief description of each location is provided below, along with the co-ordinates and approximate distance to the nearest pig shed.

Table 9: Nearest Residential Properties

Location	Description*	ING Grid Co-ordinates	Approx. distance to pig shed (m)
1	Property to the SE	259267 252824	455
2	Property to the SSE	259144 252746	400
3	Property to the South	258983 252602	445
4	Property to the SSW	258604 252601	470
5	Property to the SW	258268 252500	750
6	Property to the West	257849 252930	960
7	Property to the NW	257873 253275	940
8	Property to the NNW	258334 253480	595
9	Property to the North	258942 253959	860
10	Property to the NE	259256 253583	635

**While the property addresses could not be identified, the exact co-ordinates used in the modelling process are provided in the Table above, and all of the properties are shown in the figure in Appendix A.*

It should be noted that the closest property to the NW is owned by the applicant and a farm worker of the site lives in the dwelling. As a result it is not considered third party and has not been included for the purposes of this assessment.

4.1 Odour

Odour modelling was carried out for each individual year with the results at the nearest sensitive locations presented in Table 10, with the results graphically presented in Appendix B. All results are the odour concentration in (ou/m^3).

Table 10: 98th Percentile of the max 1-hr odour levels at nearest residential properties

Location	2015	2016	2017	2018	2019	Average
1	1.00	1.03	1.26	0.65	0.93	**0.97**
2	1.33	1.23	1.47	1.05	1.13	**1.24**
3	1.02	1.61	1.14	1.40	1.48	**1.33**
4	0.53	1.28	0.57	0.98	1.03	**0.88**
5	0.47	1.13	0.29	0.98	0.59	**0.69**
6	0.25	0.38	0.17	0.27	0.33	**0.28**
7	0.32	0.41	0.16	0.25	0.35	**0.30**
8	0.82	0.86	0.57	0.76	1.06	**0.81**
9	0.69	0.83	0.61	0.71	0.65	**0.70**
10	1.69	1.84	2.29	2.07	1.84	**1.95**

For the site layout all third party dwellings are within the 3ou/m^3 when considered as individual years and as a 5-year average of the 98th percentile.

5 CONCLUSIONS

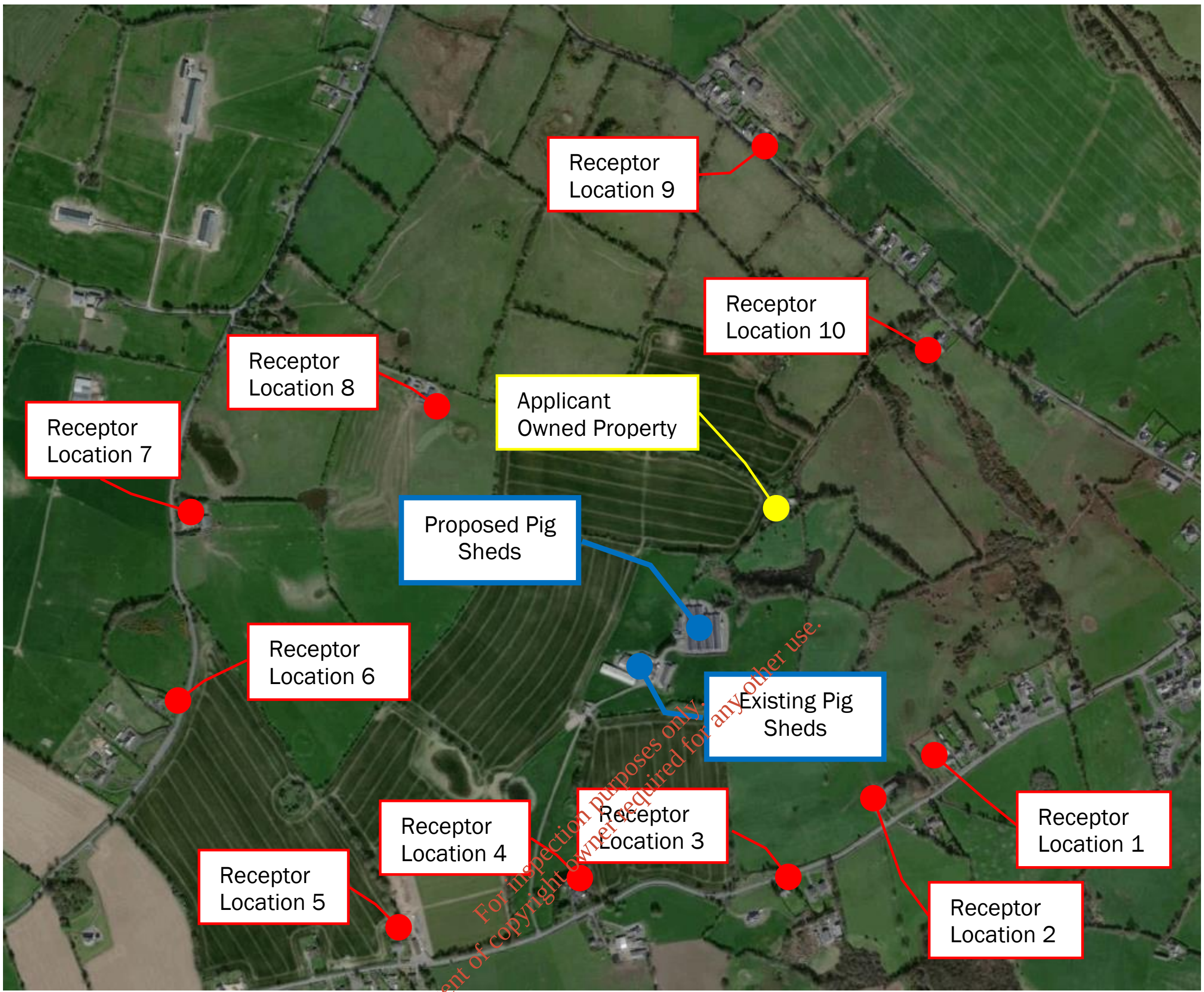
An air quality impact assessment has been undertaken for the proposed extension of Joristown Upper, Killucan, Co. Westmeath.

The maximum ground level odour concentration is predicted to be primarily confined to the immediate environs of the pig sheds. It should be noted that the predicted results in this assessment are considered worst case given that the low protein diet fed to production pigs in the breeding yard has not been accounted for.

Under the site layout, the maximum 98th percentile of 1-hour ground level odour concentration at the worst effected residential property with no interest in the operation of the pig farm, in the vicinity of the site is in accordance with the target limit value for of ≤6ou_E/m^3 when taken as an average of the 5-year period or within any individual 1-year period.

Appendix B indicates the predicted dispersion of the odour plume for 2019 for the site.

APPENDIX A SITE LAYOUT



*****Note- The above diagram is not to scale and is for illustrative purposes only. Exact co-ordinates are given in Table 9 above.***

APPENDIX B SOURCE AND RECEPTOR LOCATIONS

The information below details the AERMOD model inputs, specifically in relation to source locations, building inputs and grid receptor inputs.

Table 11: Building Location

Building Number	Irish Grid Co-ordinates (SW Corner)
E1	258733 252969
E2	258739 2529820
E3	258733 253000
E4	258760 252963
E5	258696 252960
P6	258802 253025
P7	258818 253026
P8	258834 253028
P9	258849 253029

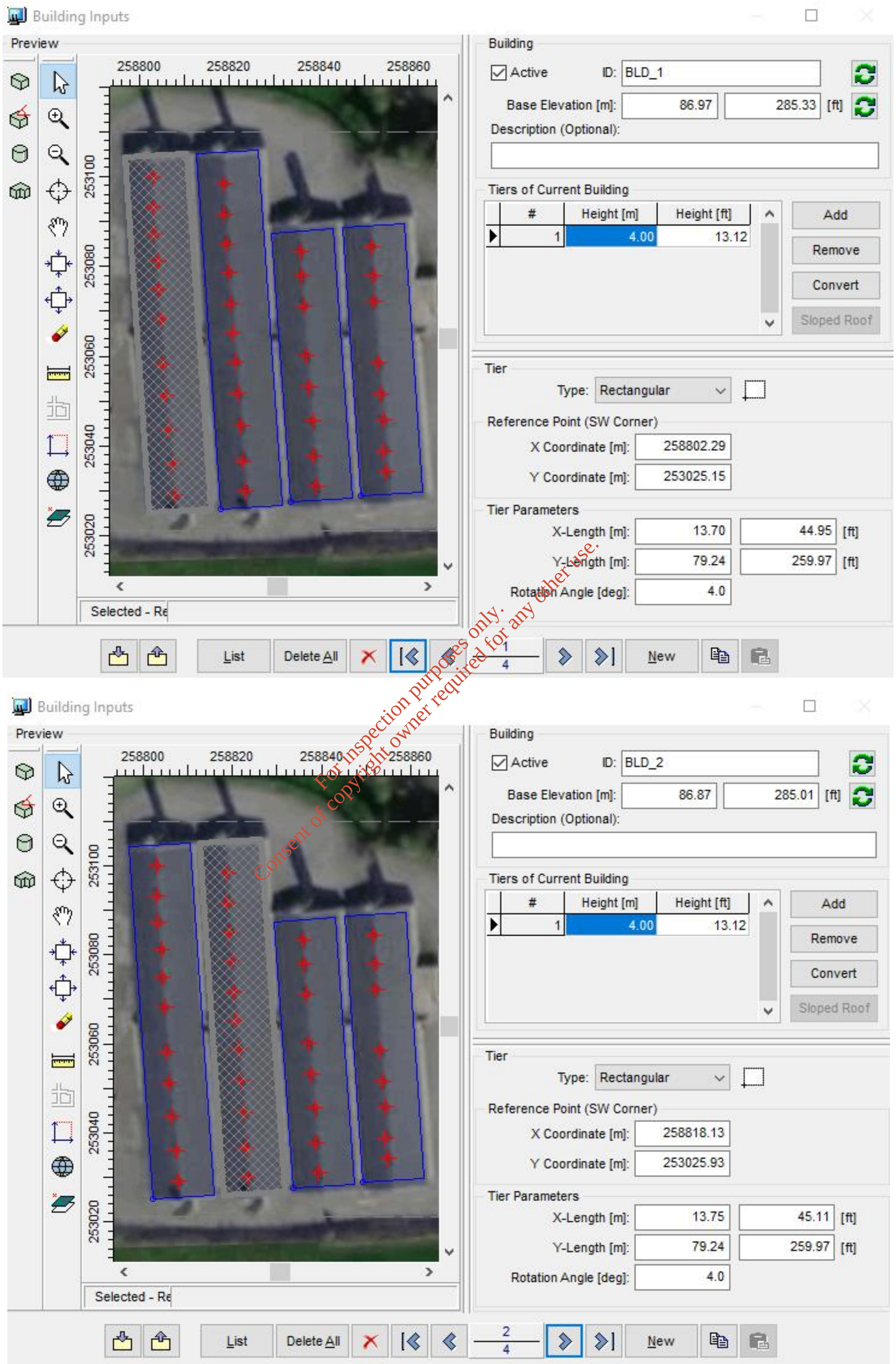
Table 12: Source Locations

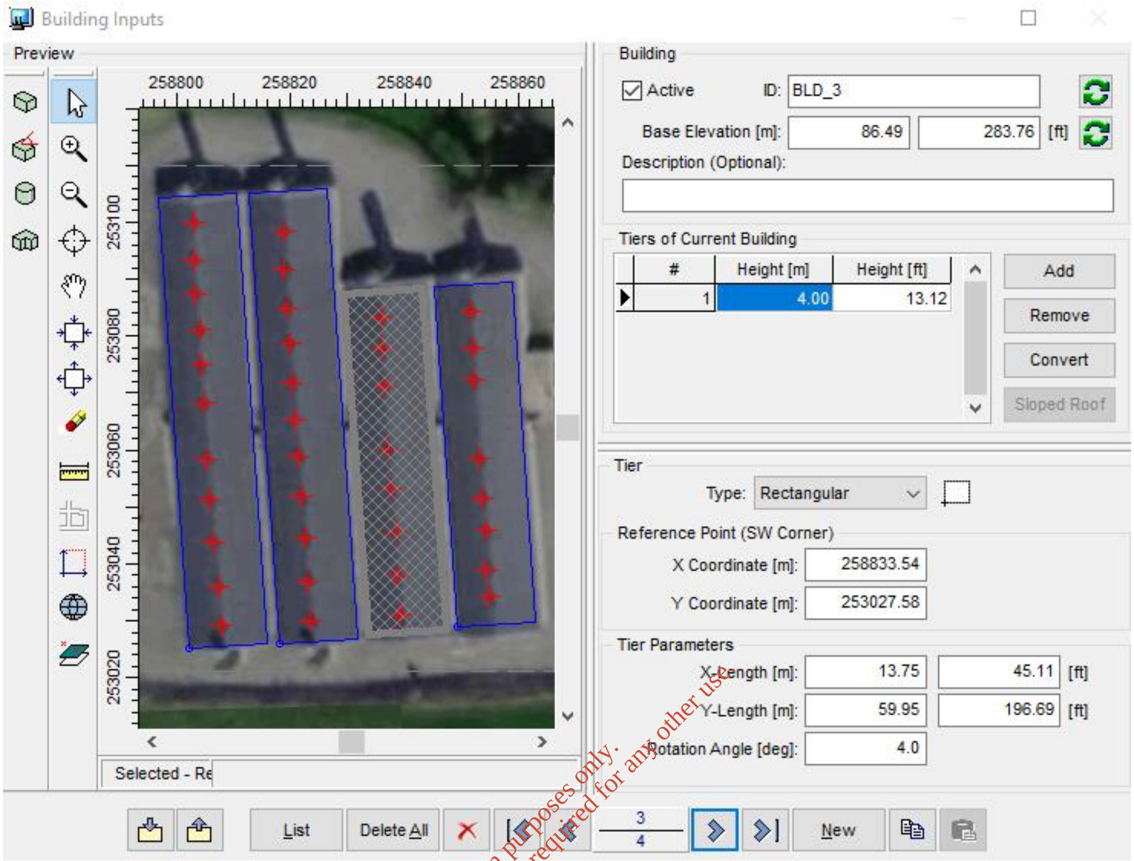
Building Number	Source	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
E1	1	258673	253001
	2	258677	253000
	3	258680	252999
	4	258688	252995
	5	258692	252993
	6	258698	252991
	7	258702	252989
	8	258709	252987
	9	258713	252985
	10	258719	252982
	11	258726	252980
	12	258732	252977
E2	1	258683	253011
	2	258688	253009
	3	258692	253008
	4	258696	253006
	5	258705	253003
	6	258709	253001
	7	258713	253000

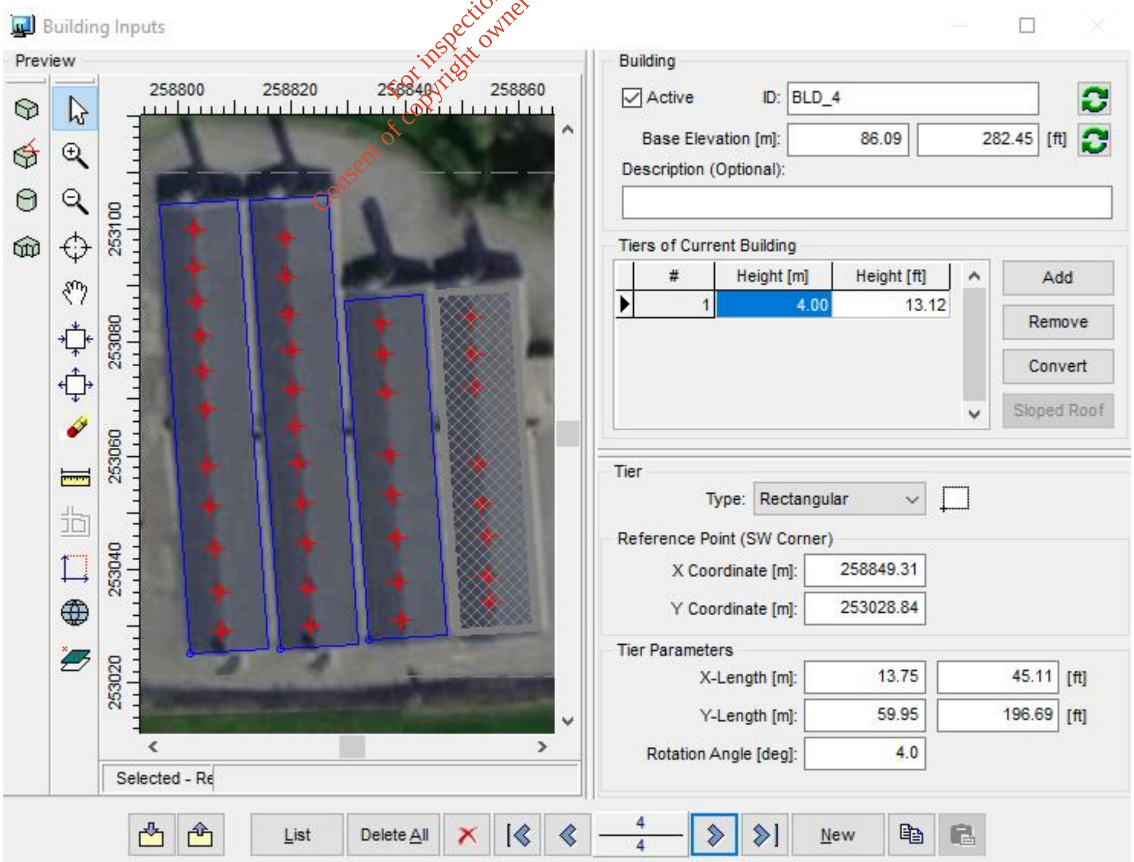
Building Number	Source	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
	8	258717	252997
	9	258730	252992
	10	258737	252989
E3	1	258717	253012
	2	258726	253008
E4	1	258764	252992
	2	258761	252987
	3	258759	252980
	4	258757	252974
	5	258754	252967
E5	1	258691	252971
	2	258677	252977
	3	258661	252983
	4	258645	252990
P1	1	258803	253100
	2	258803	253093
	3	258803	253087
	4	258804	253081
	5	258804	253075
	6	258805	253068
	7	258805	253058
	8	258806	253051
	9	258807	253044
	10	258807	253036
	11	258808	253029
P2	1	258819	253098
	2	258819	253092
	3	258819	253085
	4	258820	253079
	5	258820	253072
	6	258821	253065
	7	258821	253059
	8	258822	253052
	9	258823	253045
	10	258823	253037

Building Number	Source	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
	11	258823	253030
P3	1	258836	253083
	2	258836	253078
	3	258837	253071
	4	258837	253060
	5	258838	253053
	6	258839	253046
	7	258839	253038
	8	258839	253031
P4	1	258852	253084
	2	258852	253078
	3	258852	253072
	4	258853	253059
	5	258854	253052
	6	258854	253046
	7	258854	253039
	8	258855	253034

Figure 2: Building Inputs of Proposed Sheds

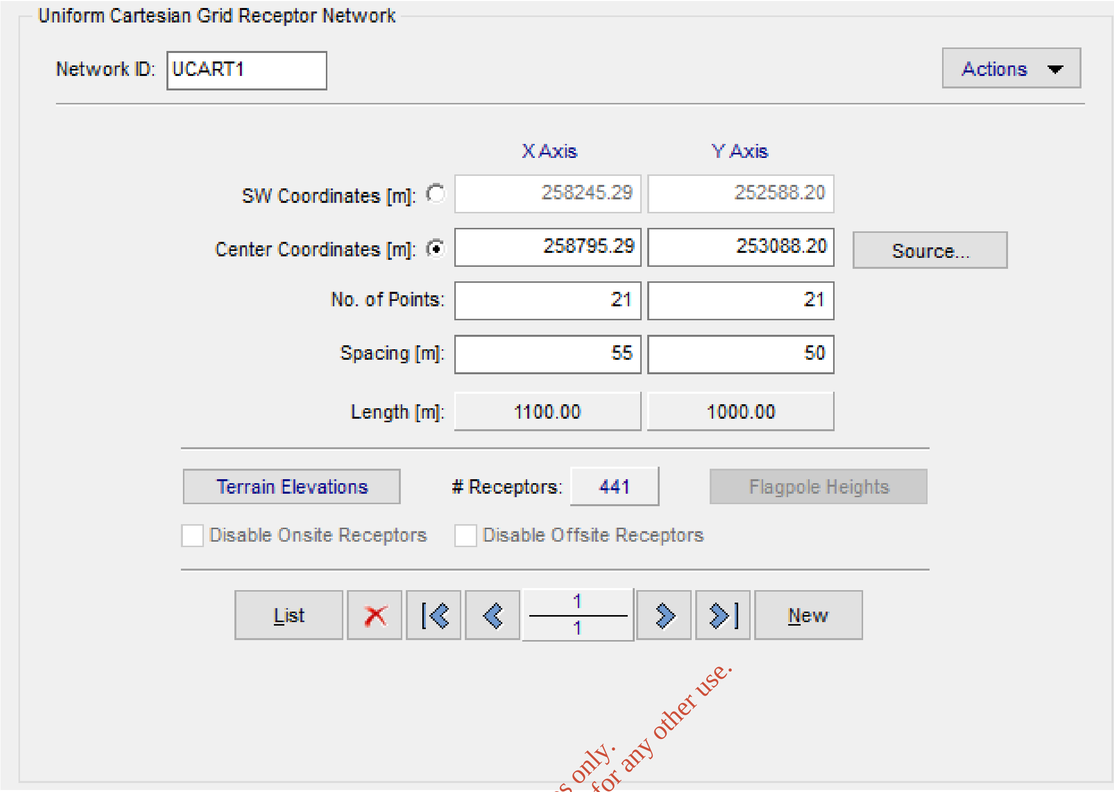






It can be seen from the Figures above that the proposed building locations input in the model reflect a rotation angle of approximately 4 degrees respectively.

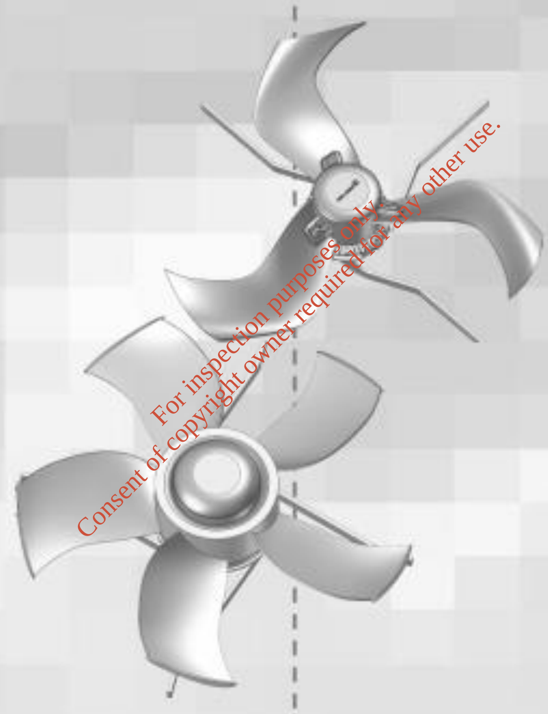
Figure 3: Details of Uniform Cartesian Grid



APPENDIX C TECHNICAL SPECIFICATION

Fans

Technical Info



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3 Technical Data

3.1 DA 600 LPC

Fan type	445091/445092 DA 600 LPC-11	445086/445087 DA 600 LPC-12	445088/445089 DA 600 LPC-13
Electric			
Voltage [V]	230 -10 % / +15%	230 -10 % / +15%	230 -10 % / +15%
Frequency [Hz]	50/60	50/60	50/60
Motor current [A] (for Motor relay)	4.2	4.2	4.2
Power [W]	800	800	800
Adjustment ability	Adjustable	Adjustable	Adjustable
Motor protection	Thermistor	Thermistor	Thermistor
Motor relay	None	None	None
Mechanic			
Cable length [m]	Max. 2m shielded cable	Max. 2m shielded cable	Max. 2m shielded cable
Min. duct diameter [mm]	636	636	636
Blade diameter [mm]	625	625	625
Number of blades [pcs.]	3	3	3
Blade pitch [°]	Periferi 25 Nav 45	Periferi 25 Nav 45	Periferi 25 Nav 45
Fan output			
Revolutions [per minute] (mark)	300-1,100	300-1,200	300-1,300
Air output [m³/h] (at -10 Pa)	13,400	14,600	15,800
Air output [m³/h] (at -20 Pa)	13,100	14,400	15,500
Air output [m³/h] (at -30 Pa)	12,900	14,100	15,200
Air output [m³/h] (at -40 Pa)	12,500	13,800	15,100
Air output [m³/h] (at -50 Pa)	12,000	13,400	14,700
Air output [m³/h] (at -60 Pa)	11,600	13,000	14,400
Power consumption [W] (at -10 Pa)	416	527	645
Specific output [m³/kWh] (at -10 Pa)	32,300	27,700	24,500
Specific energy [Watt/1000 m³/h] (at -10 Pa)	31	36	41
Pressure stability, change from 0 to -20 Pa [%]	4	3	3
Test authorities	Bygholm AAU/ SKOV A/S	Bygholm AAU/ SKOV A/S	Bygholm AAU/ SKOV A/S
Environment			
Operating temperature	÷ 40 °C to +40 °C (÷40 to 104 °F)		
Start temperature	÷ 40 °C to +50 °C (÷40 to 122 °F)		
Storage temperature	÷ 40 °C to +70 °C (÷40 to 158 °F)		
Ambient humidity, operation	10-95 % RH		

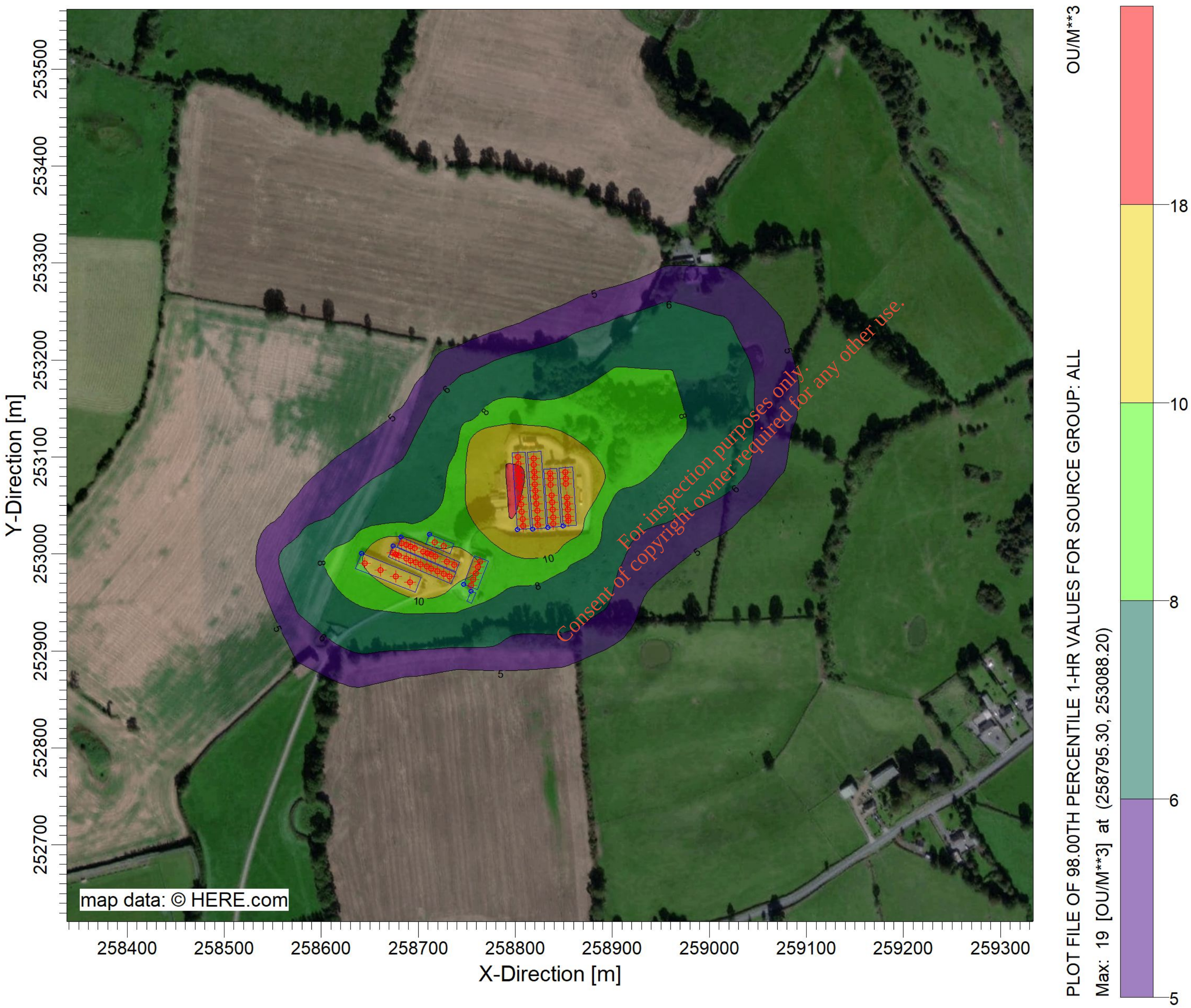
SKOV Fans

APPENDIX D MODELLING RESULTS

PROJECT TITLE:

Joristown Piggery

98%tile of Max 1-Hour Ground Level Odour Concentration (ou/m3) (2019)



COMMENTS:

Plume reflects a reduction for low protein diet and regular removal of slurry applied to proposed sheds

SOURCES:

71

RECEPTORS:

451

OUTPUT TYPE:

Concentration

MAX:

19 OU/M3**

COMPANY NAME:

MODELER:

DATE:

14/03/2021

SCALE: 1:6,404

0 0.2 km

PROJECT NO.:

2019182