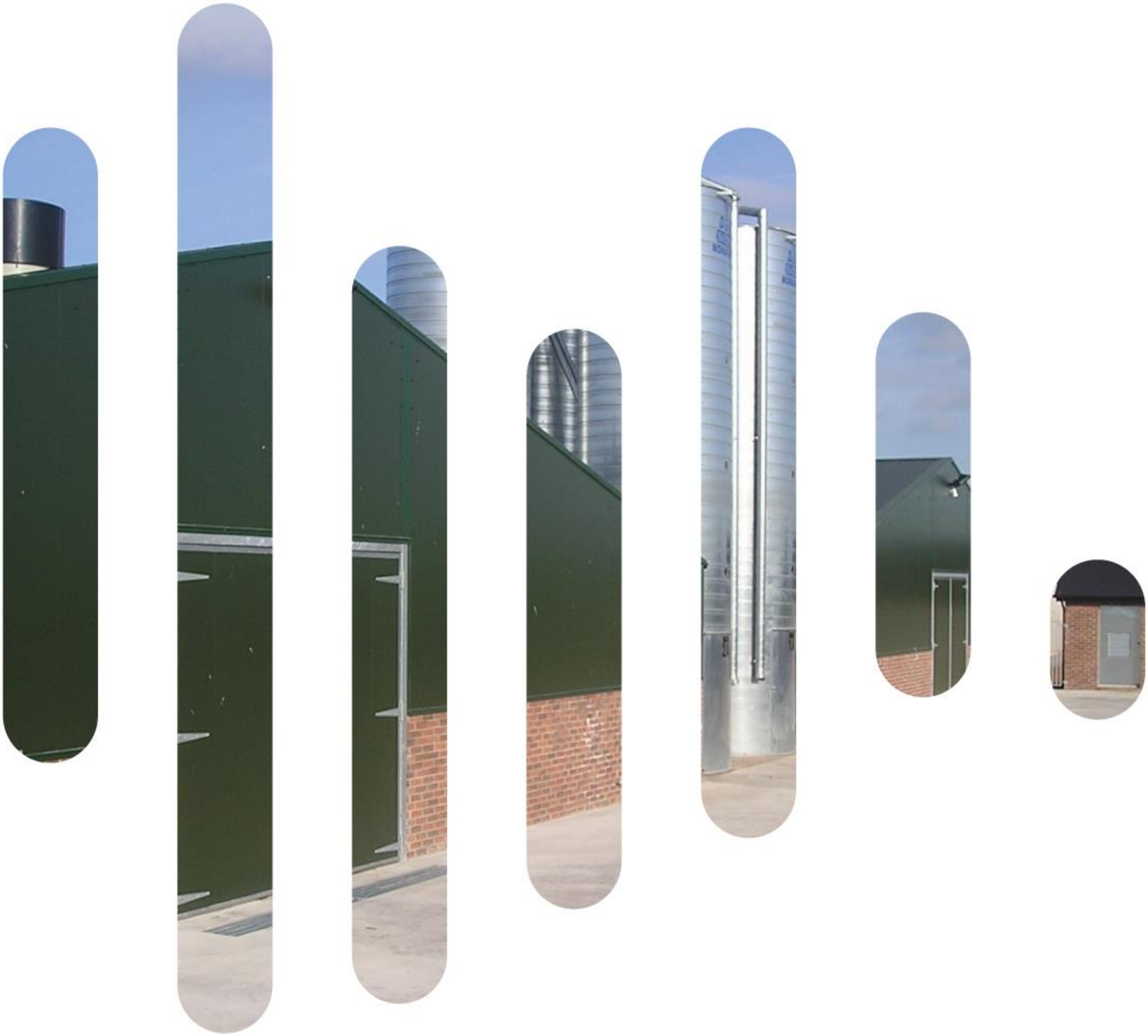

ODOUR IMPACT ASSESSMENT
EOIN O'BRIEN PIGS

Rp003 2020191 (Eoin O'Brien Pigs)
23 January 2023

PROJECT:	AIR QUALITY IMPACT ASSESSMENT
PREPARED FOR:	EOIN O'BRIEN C/O CLW ENVIRONMENTAL PLANNERS THE MEWS 23 FARNHAM STREET CAVAN
ATTENTION:	PARAIC FAY
REPORT NO.:	Rp 003 2020191- ODOUR

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1 INTRODUCTION

Irwin Carr Ltd have been commissioned to undertake air quality dispersion modelling for an existing pig farm at Mogeely, Co. Cork.

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 has the provision for sixteen mechanically ventilated pig sheds which house a total of 19,910 pigs of varying size and type.

In order to accurately predict the odour impact from the site, all 12 sheds (with updated building names) have been included as part of this assessment as well as 3 on site slurry stores, for the purposes of an EPA licence application.

As part of this application, a low protein diet has been included, the associated reductions of which are included in Section 3.2.3 below.

In addition to the low protein diet detailed above, additional mitigation is also incorporated 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 to covered slurry tanks located on site.

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

1.2 Application History

This report is further to an original assessment completed by Irwin Carr, as well as a consultation response from the EPA in January 2023. The EPA points in relation to odour are addressed in order below:

1. *'Updated emissions for slurry storage which correspond with the screening tool. The emission factors applied to the slurry tanks (FS13, FS14, and FS15) in your calculations do not correspond with the emission factors in the screening tool;'*

   The emission factors for slurry storage have been updated and now correspond with the EPA odour screening tool.

2. *'The odour benchmark of 5 OUe/m3 which applies to existing pig-production units and sites licensed by the EPA between 2001 and 15th February 2017. The odour benchmark of 6 OUe/m3 which was used in your calculations is not acceptable as it applies only to sites licensed by the EPA prior to 2001 and not reviewed since this date;'*

   While it was noted in the previous report that an odour benchmark of $6ou_E/m^3$ was applicable, all of the predicted odour impacts complied with the lower benchmark of $5ou_E/m^3$, which has been applied as part of this amended assessment.

3. *'Input and output data from the screening tool; and'*

   No screening assessment has been undertaken for this site, and this more detailed modelling assessment has been provided to demonstrate that the appropriate benchmark will not be exceeded.

4. *'Where the output data indicates that the calculated concentration at the closest sensitive receptor (165 m) for this installation's dispersion characteristics is above 5.0 OUe/m3, provide a more detailed odour assessment to evaluate odours fully and to outline any further abatement/mitigation that will need to be applied.'*

   The predicted odour impacts from this amended assessment show that the benchmark of $5ou_E/m^3$ is not exceeded at any of the closest third-party receptors and as a result, further abatement/ mitigation is not required.

It is the purpose of this additional report to address the queries above.

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, the odour target value of C98, 1-Hour ≤ 5 ou/m^3 will be adopted at the nearest sensitive receptor. This benchmark applies to existing pig-production units and sites licensed by the EPA between 2001 and 15th February 2017.

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 98^{th} percentile of hourly averages. For a typical meteorological year the dispersion model predicts 8,760 hourly concentrations for each receptor location. The 98^{th} 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 pig houses.

Table 2: Dimensions of Pig Houses

	Dimensions	Total No. of Pigs	Efflux Temp	Emissions
FS1	88.4m x 22.8m x 6.5m	525 x Dry Sows	20 °C	Mechanically Ventilated
FS2	88.7m x 18.8m x 6.5m	225 x Farrowing	20 °C	Mechanically Ventilated
FS3	71.2m x 16.3m x 6.5m	225 x Farrowing	20 °C	Mechanically Ventilated
FS4	71.2m x 18m x 6.5m	525 x Dry Sows	20 °C	Mechanically Ventilated
FS5	36.9m x 15.1m x 6.5m	800 x Weaners	20 °C	Mechanically Ventilated
FS6	36.7m x 16.3m x 6.5m	900 x Weaners	20 °C	Mechanically Ventilated
FS7	41.2m x 18.7m x 6.5m	1,075 x Weaners	20 °C	Mechanically Ventilated
FS8	41.2m x 18.7m x 6.5m	1,075 x Weaners	20 °C	Mechanically Ventilated
FS9	44.6 x 41.5m x 6.5m	2,150 x Weaners	20 °C	Mechanically Ventilated

Table 3: Dimensions of Fattening Sheds

	Dimensions	Total No. of Pigs per Shed	Efflux Temp	Emissions
FS10	110m x 50.1m x 6.5m	2,600 x Growers 3,900 x Fatteners	20 °C	Mechanically Ventilated
FS11	110m x 35.1m x 6.5m	1,360 x Growers 2,040 x Fatteners	20 °C	Mechanically Ventilated
FS12	55m x 43.5m x 6.5m	840 x Growers 1,260 x Fatteners 410 x Maiden Gilts (incl. 10 x Boars)	20 °C	Mechanically Ventilated

It can be seen from the Table above that sheds FS9 – FS12 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 EARTH BERM

It has been confirmed that there is an earth berm located around all of the sheds on site.

This berm is 8m in height and provides a line of site barrier between all of the sheds on site and the nearest sensitive receptors to the site, specifically to the east.

A drawing showing the earth berm is included in Appendix A and it is represented in the AERMOD model by the inclusion of an 8m building surrounding the site. It should be noted that the natural berm and associated landscaping will offer some absorptive capacity which is not reflected in the AERMOD model given that it has been included as a solid building.

[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).

3.2.2 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 sheds.

3.2.3 MITIGATION

The baseline emission factors for pigs have been outlined in Guidance published by the Environmental Protection Agency[1]. Section 4.2 of this Guidance document also details the basic principles for reducing odour emissions, namely:

- *Manipulating dietary protein & supplements: Reduction of the protein content in feed (Page 25, Section 4.2.1).*
- *Improved slurry management offered by integrated housing techniques: Frequent removal of slurry and storage in closed tanks (Page 26, Section 4.2.2.)*

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.

The relevant Sections included in the points above also detail the reductions associated with each measure:

- Low Protein: For detailed modelling, it would be reasonable to apply a reduction factor of 10% on the basis of a reduction of 1% crude protein in the diet. The maximum reduction factor that can be applied is 30% linked to a reduction of 3% crude protein in the diet.
- Frequent Removal of Slurry: For carrying out detailed modelling it would be reasonable to apply a reduction factor of 25% irrespective of the technique being employed (e.g., frequent slurry removal / slurry cooling).

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.

Section 4.2.3 of the EPA Guidance provides advice on mitigation offered by more than one mitigation technique, as is the case with this proposal. Within the Guidance it is noted,

> *'Until further scientific evidence is available to the contrary, where two mitigation techniques are operated on the same pig rearing installation, the applicant should be limited to:*
>
> - *100% of the odour reduction offered by the first mitigation technique; and*
> - *no more than 50% of the odour reduction offered by the second mitigation technique'.*

Given that the mitigation associated with the second technique (frequent removal of slurry) is 25%, only 50% of this has been applied, and the Table below takes account of an additional 12.5% reduction.

Table 4: Final Odour Emission Factors accounting for Mitigation

Category of Animal	Baseline Emission Factor (ou/s/animal)	Total Reduction	Levels after Reduction (ou/s/animal)
Dry Sows	21	42.5%	**12.08**
Growers	12		**6.90**
Fatteners/ Maiden Gilts	20		**11.50**
Farrowing	20		**11.50**
Weaners*	6	25%	**4.50**

**The full 25% reduction is applied to weaners for the regular removal of slurry, where no reduction has been applied for the incorporation of a low protein diet.*

Table 5 below details the total emission rates per shed, based on the emission factors calculated above.

Table 5: 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)
FS1	525 x Dry Sows	12.08	6,339.4	6,339.4
FS2	225 x Farrowing	11.50	2,587.5	2,587.5
FS3	225 x Farrowing	11.50	2,587.5	2,587.5
FS4	525 x Dry Sows	12.08	6,339.4	6,339.4
FS5	800 x Weaners	4.50	3,600	3,600
FS6	900 x Weaners	4.50	4,050	4,050
FS7	1,075 x Weaners	4.50	4,837.5	4,837.5
FS8	1,075 x Weaners	4.50	4,837.5	4,837.5
FS9	2,150 x Weaners	4.50	9,675	9,675
FS10	2,600 x Growers	6.90	17,940	62,790
	3,900 x Fatteners	11.50	44,850	
FS11	1,360 x Growers	6.90	9,384	32,844
	2,040 x Fatteners	11.50	23,460	
FS12	840 x Growers	6.90	5,796	25,001
	1,670 x Fatteners (incl. 400 x Gilts & 10 x Boars)	11.50	19,205	

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 6 below shows the emission rates coming out of emission point.

Table 6: Emission Rates for each stack

House No.	No of Fans (and type)	Odour per fan (ou/s)
FS1	3 x BD-FF063 6DT	**937**
	3 x BD-FF063 Zit (S)	**1,176**
FS2	12 x Skov DA600	**216**
FS3	4 x BD-FF063 6DT	**287**
	4 x BD-FF063 Zit (S)	**360**
FS4	3 x BD-FF063 6DT	**937**
	3 x BD-FF063 Zit (S)	**1,176**
FS5	3 X Skov DA600	**1,200**
FS6	3 x BD-FF063 6DT	**599**
	3 x BD-FF063 Zit (S)	**751**
FS7	6 X Skov DA600	**806**
FS8	6 X Skov DA600	**806**
FS9	14 x BD-FF063 Zit (S)	**691**
FS10	24 x BD-FF091	**2,616**
FS11	16 x BD-FF091	**2,053**
FS12	12 x BD-FF091	**2,083**

3.2.4 STACK EMISSIONS VELOCITY

There are four types of fan on the site, Table 7 below shows the ventilation rates for the chosen fan types.

Table 7: Ventilation Rates for fan

Fan Type	Stack Diameter (m)	Cross Sectional Area (m^2)	Exit Velocity (m/s)	Volume Flow (m^3/s)	Volume Flow (m^3/hr)
BD-FF063 6DT	0.63	0.312	10.87	3.39	12,200
BD-FF091	0.91	0.651	9.82	6.39	23,000
Skov DA600	0.6	0.283	11.98	3.39	12,200
BD-FF063 Zit (S)	0.63	0.312	13.63	4.25	15,300

**The technical specifications of these fans are provided in Appendix C.*

3.2.5 SLURRY STORAGE

The covering of slurry lagoons with rigid covers is considered best practice and is detailed in the BREF Document[3] as the best available technique in reducing emissions from lagoons.

It is stated within the BREF Document that,

> *"Purpose-built (rigid) covers are reported to give reductions of at least 80-90% for ammonia and odour emissions associated with manure storage."*

Emission rates for lagoons with rigid covers are provided in the EPA Odour Screening Tool, as shown in Table 8 below.

Table 8: Concentrations per Building

Source Ref.	Details	Area (m^2)	Cover	Emission Factor ($ou/m^2/s$)	Total Emissions (ou/s)
FS13	Overground Slurry Tank	255	Rigid Cover	2	510
FS14	Covered Slurry Tank	380	Rigid Cover	2	760
FS15	Covered Slurry Tank	295	Rigid Cover	2	590

The emissions above detail the total odour leaving each of the tanks each second.

[3] *JRC Science for Policy Report. Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry and Pigs. Industrial Emission Directive 2010/75/EU (IPPC). 2017. Section 4.11.2.2*

3.3 Meteorological Data

For this assessment, five years' worth of meteorological data (2016 – 2020) has been derived from the three-dimensional Weather Research and Forecasting (WRF) mesoscale model. The data has been generated from a nested domain area centered on the Shannon Airport meteorological site at a grid resolution of 4 km.

The annual wind speed at the site was estimated as 6m/s, as shown on the MET Eireann website[4]. Using a ratio of 0.9 – 1.1, the preferable wind speed for the meteorological site is 5.4m/s – 6.6m/s. It can also be seen from the Figure that the average wind speed at Shannon Airport is approx. 5.5m/s, which is within the preferred range of wind speeds for the site.

Given that the average wind speed at Shannon is similar to that at the source location, and also taking into account that both locations are within approx. 10km of the coast, it was deemed 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 corresponding meteorological datasets for the assessment have been acquired from Lakes Environmental who utilise the WRF model, a mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting applications to generate a representative, high resolution meteorological dataset suitable for use within AERMOD. The model is used globally to simulate weather conditions by drawing from observations and archived climatological model data and objective analysis to generate gridded meteorological parameters horizontally and vertically for a region.

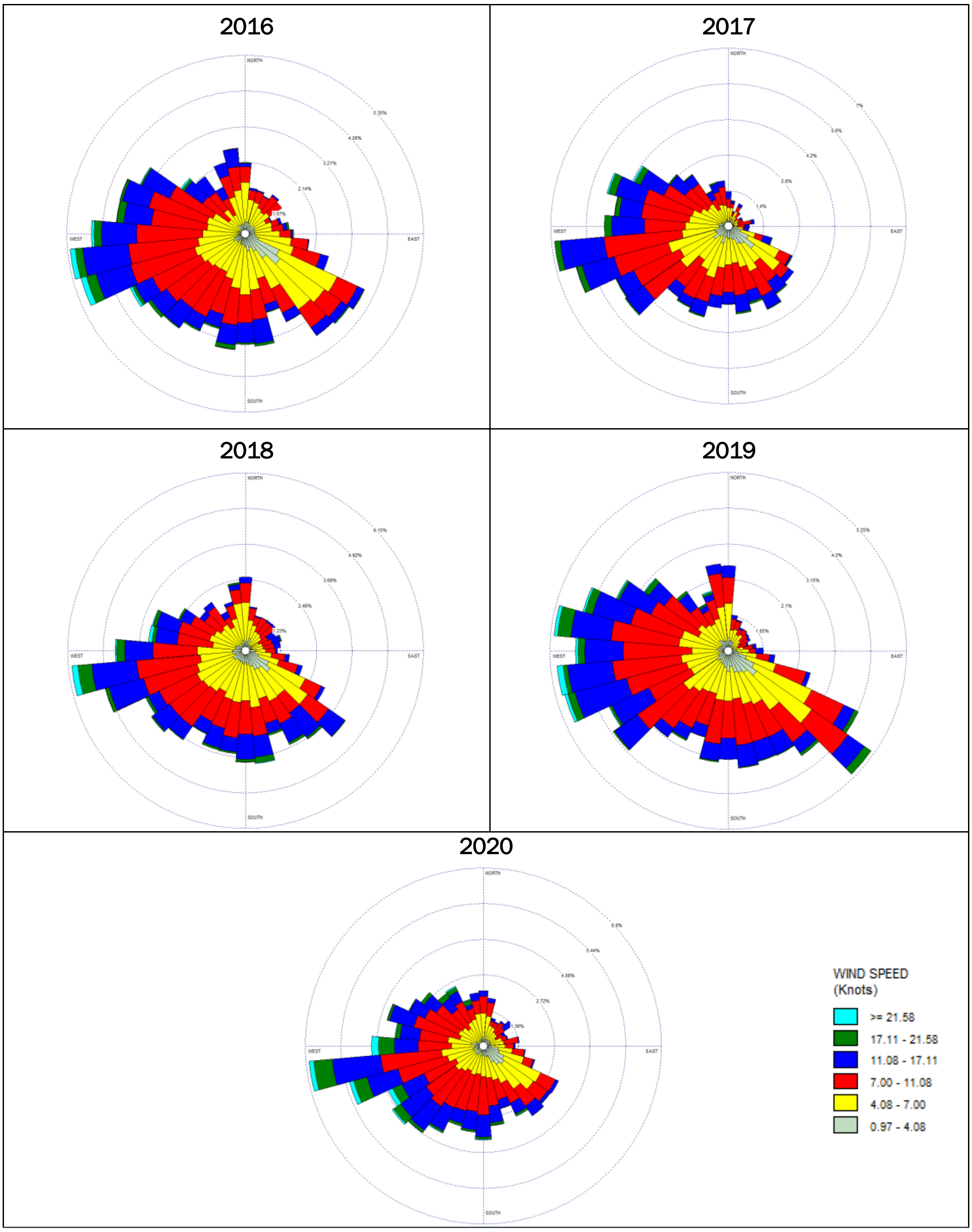
Lake Environmental then employ the Mesoscale Model Interface Program (MMIF) to convert the prognostic WRF meteorological model output to AERMET pre-processor data input format prior to use within AERMOD.

Surface roughness of the files was updated and is confirmed as grassland, which is the dominant land type around the site.

The associated wind rose plots derived for each individual year are presented in Figure 1 below.

[4] *MET Eireann website available at: [Wind - Met Éireann - The Irish Meteorological Service]*

Figure 1: Annual Windrose Data- Shannon Airport



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 pig houses 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 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 East	198029 076661	630
2	Property to the East	197727 076617	330
3	Property to the East	197717 076519	295
4	Property to the East	197696 076510	270
5	Property to the East	197599 076453	165
6	Property to the South	197455 076260	195
7	Property to the SE	197719 075775	750
8	Property to the SW	197213 076036	415
9	Property to the SW	197192 075988	465
10	Property to the SW	196738 076074	695

**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.*

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	2016	2017	2018	2019	2020	Average
1	1.22	1.40	1.28	1.02	1.20	**1.22**
2	3.11	3.51	3.37	2.78	3.16	**3.19**
3	2.78	3.37	2.97	2.93	2.94	**3.00**
4	3.02	3.58	3.16	3.25	3.24	**3.25**
5	4.57	5.00	4.03	4.66	4.47	**4.55**
6	3.32	3.80	3.45	3.66	3.34	**3.51**
7	0.49	0.62	0.60	0.57	0.55	**0.57**
8	2.29	1.08	2.02	1.57	2.32	**1.86**
9	1.96	0.88	1.55	1.23	1.93	**1.51**
10	0.71	0.46	0.74	0.46	0.64	**0.60**

For the site layout, it can be seen from the Table above that there is no exceedance of the 5ou/m^3 in each of the 5 years, or when considered as a 5-year average at all of the receptors in the vicinity of the sheds.

5 CONCLUSIONS

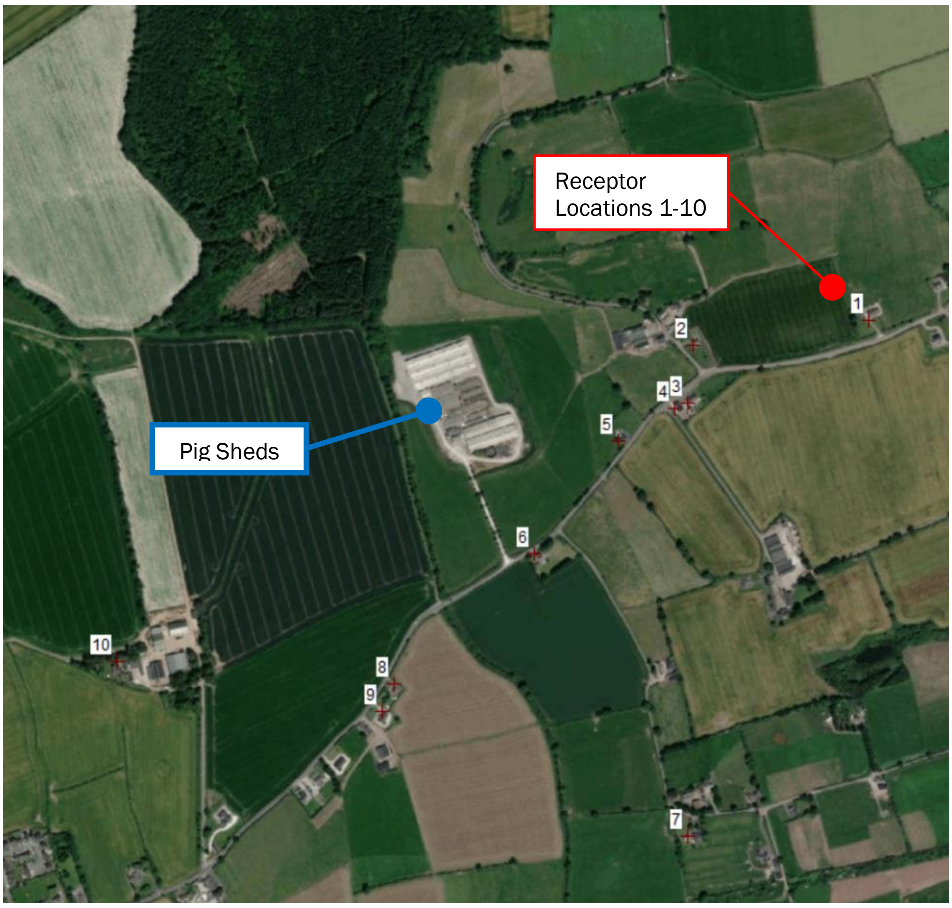
An air quality impact assessment has been undertaken for an extension to an existing pig farm at Mogeely, Co. Cork.

The maximum ground level odour concentration is predicted to be primarily confined to the immediate environs of the pig sheds.

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 $\leq 5ou_E/m^3$ when taken as an average of the 5-year period.

Appendix B indicates the predicted dispersion of the odour plume for 2020 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 10 above.*

The Figure below shows the 8m high earth berm around the pig site.

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)
FS1	197344 76431
FS2	197337 76454
FS3	197346 76478
FS4	197340 76496
FS5	197302 76472
FS6	197297 76487
FS7	197288 76504
FS8	197280 76525
FS9	197330 76518
FS10	197251 76543
FS11	197234 76591
FS12	197229 76628
FS13	197373 76425
FS14	197394 76422
FS15	197273 76499

Table 12: Source Locations

Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
FS1	1	A	7.1	197348	76443
	2	D	7.1	197361	76448
	3	A	7.1	197375	76452
	4	D	7.1	197388	76457
	5	A	7.1	197400	76461
	6	D	7.1	197413	76465
FS2	1	C	7.1	197336	76463
	2	C	7.1	197342	76465
	3	C	7.1	197348	76467
	4	C	7.1	197353	76469
	5	C	7.1	197359	76471
	6	C	7.1	197365	76473
	7	C	7.1	197370	76474
	8	C	7.1	197376	76477
	9	C	7.1	197381	76479
	10	C	7.1	197387	76480
	11	C	7.1	197401	76482
	12	C	7.1	197414	76486
FS3	1	A	7.1	197350	76484
	2	D	7.1	197360	76487
	3	A	7.1	197368	76491
	4	D	7.1	197376	76493
	5	A	7.1	197384	76496
	6	D	7.1	197392	76499
	7	A	7.1	197399	76501
	8	D	7.1	197407	76504
FS4	1	A	7.1	197344	76506
	2	D	7.1	197353	76510
	3	A	7.1	197362	76513
	4	D	7.1	197373	76516
	5	A	7.1	197387	76521
	6	D	7.1	197397	76524
FS5	1	C	7.1	197303	76480
	2	C	7.1	197315	76484

Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
	3	C	7.1	197326	76488
FS6	1	A	7.1	197299	76492
	2	D	7.1	197311	76496
	3	A	7.1	197323	76501
	4	D	7.1	197297	76498
	5	A	7.1	197309	76502
	6	D	7.1	197320	76506
FS7	1	C	7.1	197293	76511
	2	C	7.1	197305	76515
	3	C	7.1	197318	76520
	4	C	7.1	197290	76518
	5	C	7.1	197303	76523
	6	C	7.1	197315	76527
FS8	1	C	7.1	197285	76532
	2	C	7.1	197298	76536
	3	C	7.1	197311	76541
	4	C	7.1	197282	76539
	5	C	7.1	197295	76544
	6	C	7.1	197309	76548
FS9	1	D	7.1	197332	76530
	2	D	7.1	197337	76531
	3	D	7.1	197343	76533
	4	D	7.1	197348	76535
	5	D	7.1	197353	76536
	6	D	7.1	197357	76538
	7	D	7.1	197362	76539
	8	D	7.1	197324	76548
	9	D	7.1	197329	76550
	10	D	7.1	197336	76552
	11	D	7.1	197341	76554
	12	D	7.1	197347	76556
	13	D	7.1	197352	76557
	14	D	7.1	197357	76559
	1	B	7.4	197260	76553
	2	B	7.4	197263	76554

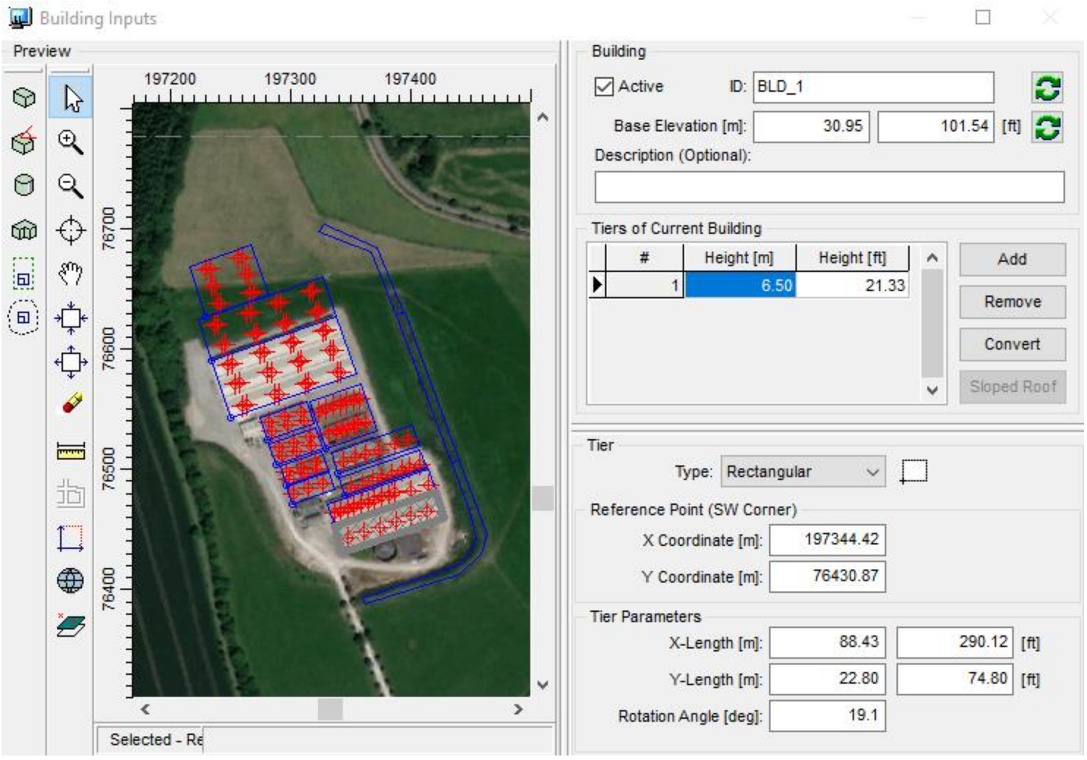
Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
FS10	3	B	7.4	197287	76562
	4	B	7.4	197290	76563
	5	B	7.4	197312	76571
	6	B	7.4	197315	76572
	7	B	7.4	197339	76581
	8	B	7.4	197342	76581
	9	B	7.4	197254	76571
	10	B	7.4	197257	76572
	11	B	7.4	197281	76580
	12	B	7.4	197284	76581
	13	B	7.4	197306	76589
	14	B	7.4	197308	76590
	15	B	7.4	197333	76599
	16	B	7.4	197336	76599
	17	B	7.4	197248	76587
	18	B	7.4	197251	76588
	19	B	7.4	197275	76596
	20	B	7.4	197278	76597
	21	B	7.4	197300	76605
	22	B	7.4	197302	76606
	23	B	7.4	197327	76615
	24	B	7.4	197329	76615
FS11	1	B	7.4	197242	76603
	2	B	7.4	197245	76604
	3	B	7.4	197269	76613
	4	B	7.4	197272	76613
	5	B	7.4	197294	76621
	6	B	7.4	197297	76622
	7	B	7.4	197321	76631
	8	B	7.4	197324	76632
	9	B	7.4	197237	76620
	10	B	7.4	197240	76621
	11	B	7.4	197264	76629
	12	B	7.4	197267	76630
	13	B	7.4	197288	76638

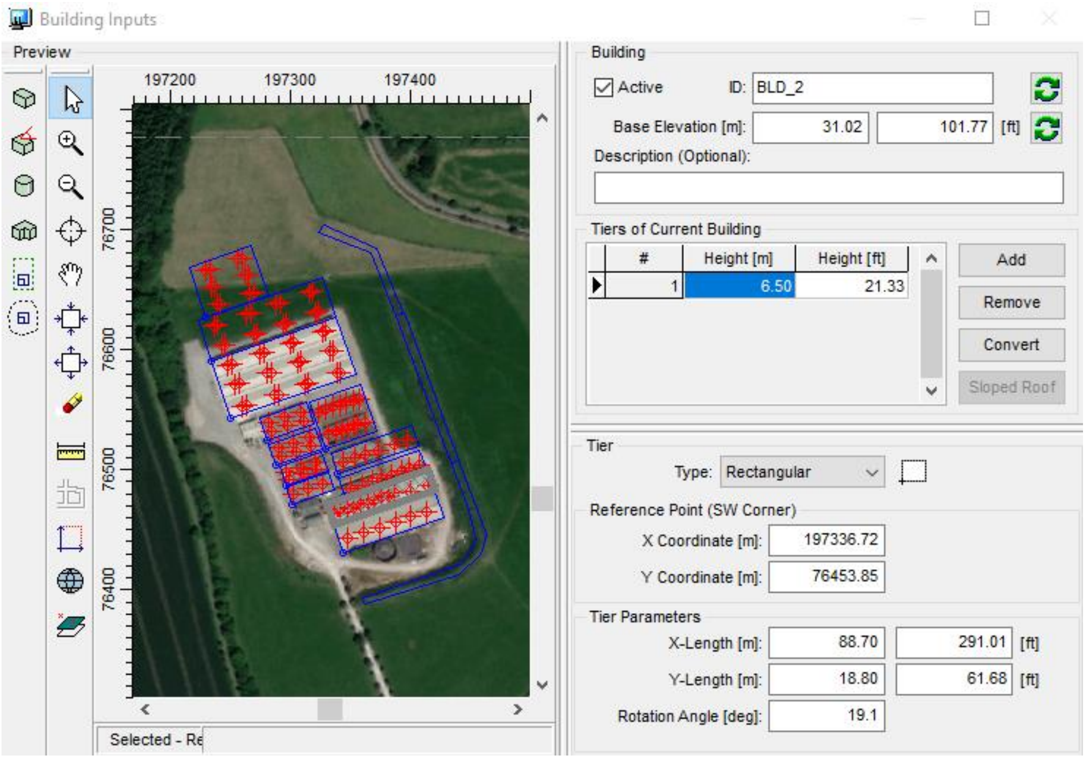
Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
	14	B	7.4	197291	76639
	15	B	7.4	197316	76648
	16	B	7.4	197318	76648
FS12	1	B	7.4	197239	76638
	2	B	7.4	197242	76638
	3	B	7.4	197266	76647
	4	B	7.4	197269	76648
	5	B	7.4	197235	76652
	6	B	7.4	197237	76653
	7	B	7.4	197262	76662
	8	B	7.4	197264	76662
	9	B	7.4	197230	76666
	10	B	7.4	197233	76667
	11	B	7.4	197257	76675
	12	B	7.4	197260	76676

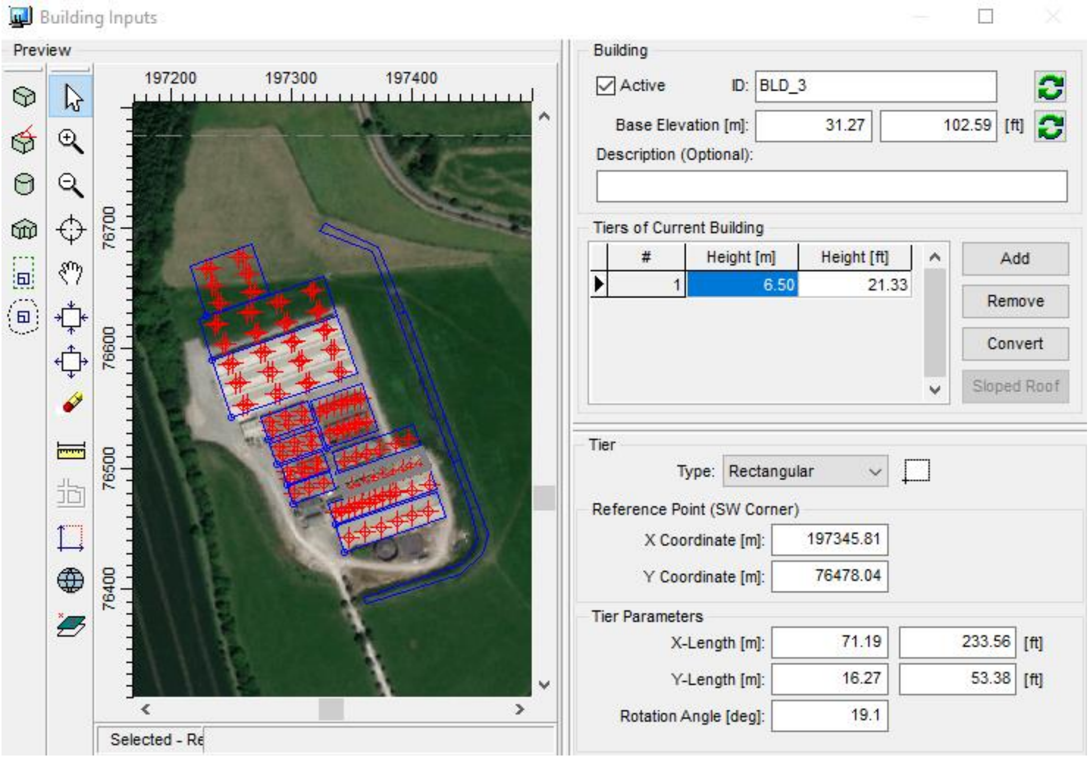
Details of each source type are provided in Table 8 above and summarised below:

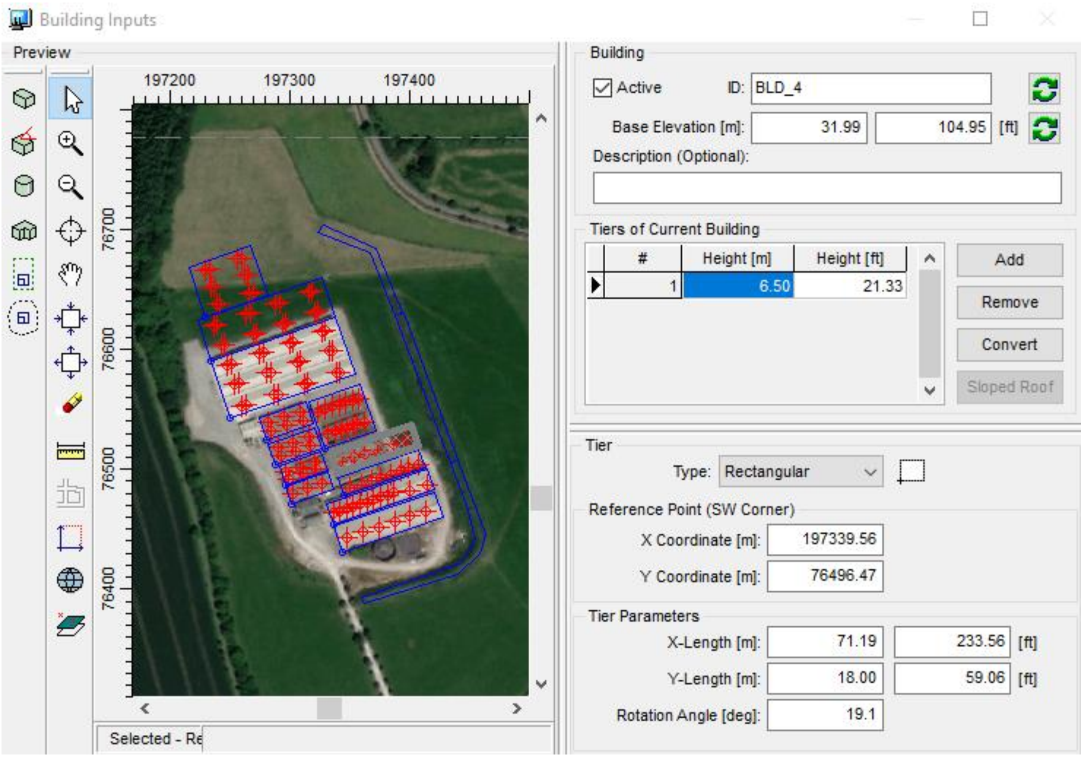
- A: BD-FF063 6DT
- B: BD-FF091
- C: Skov DA600
- D: BD-FF063 Zit (S)

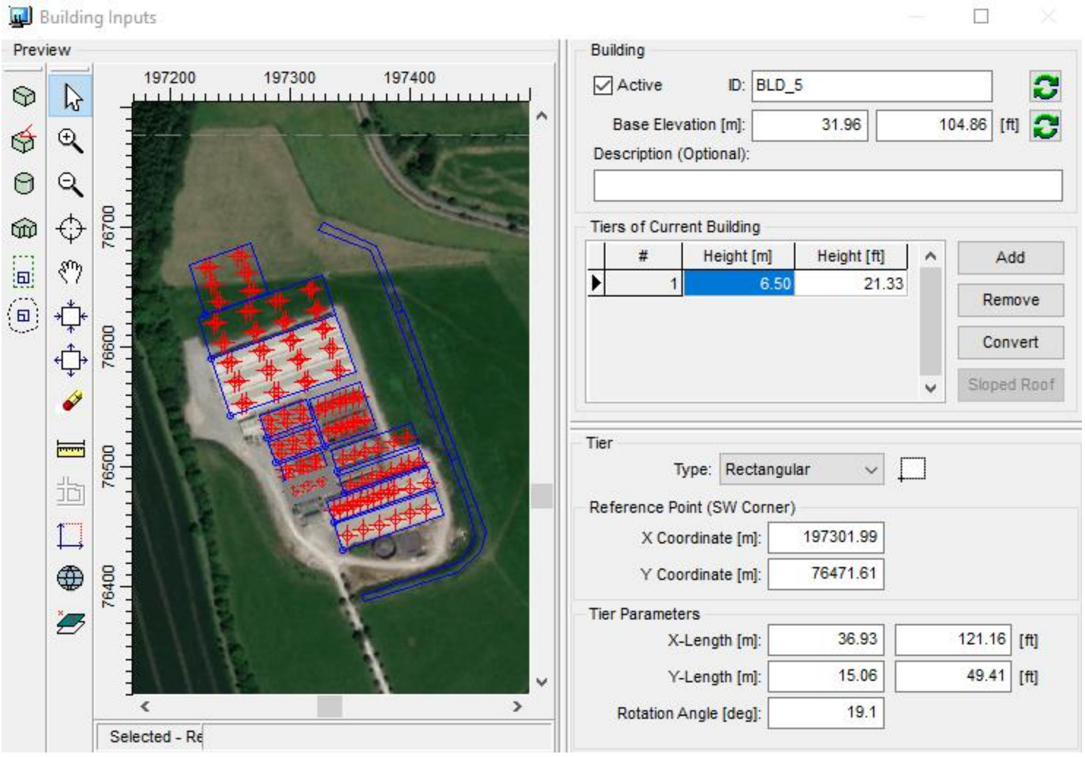
Figure 2: Building Inputs of Sheds FS1 – FS12

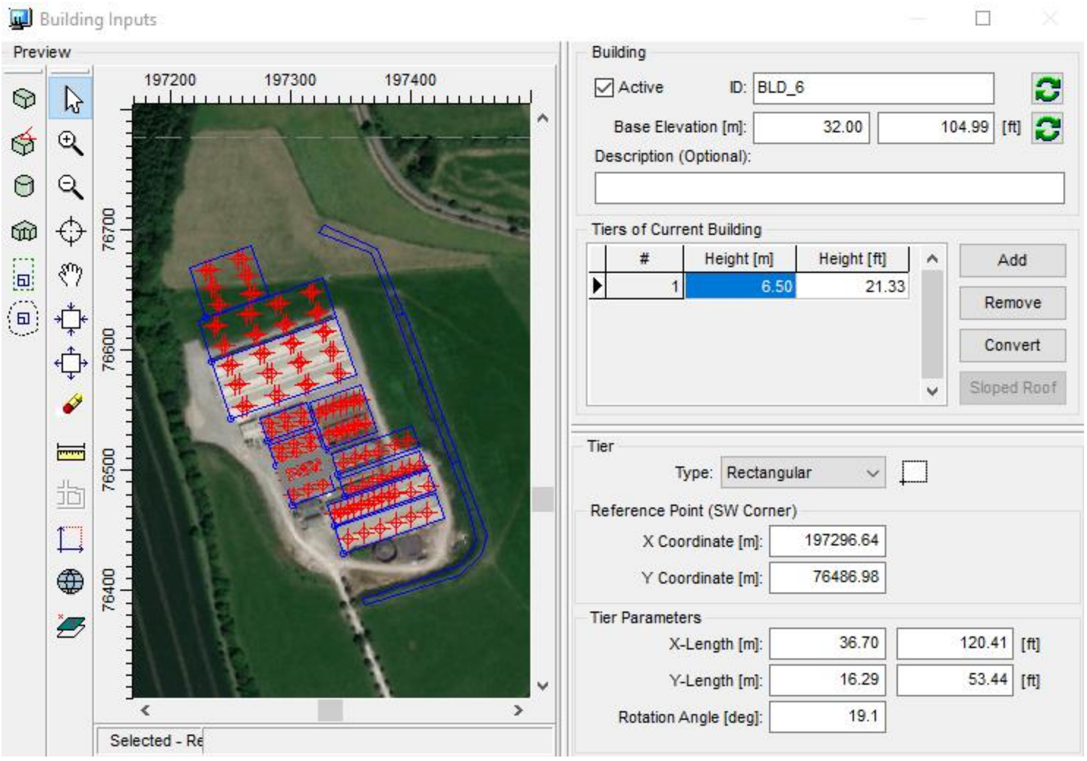


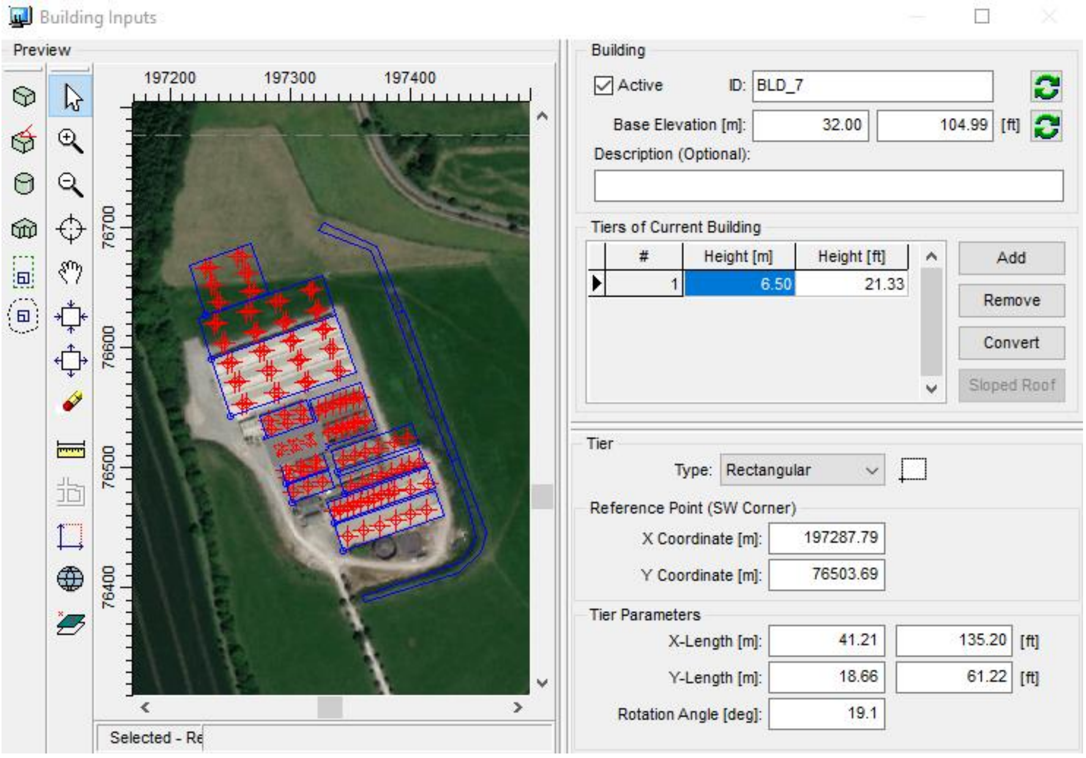



Building Inputs
Preview
197200
197300
197400
76700
76600
76500
76400
Selected - Re
Building
Active
ID: BLD_3
Base Elevation [m]: 31.27 102.59 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197345.81
Y Coordinate [m]: 76478.04
Tier Parameters
X-Length [m]: 71.19 233.56 [ft]
Y-Length [m]: 16.27 53.38 [ft]
Rotation Angle [deg]: 19.1

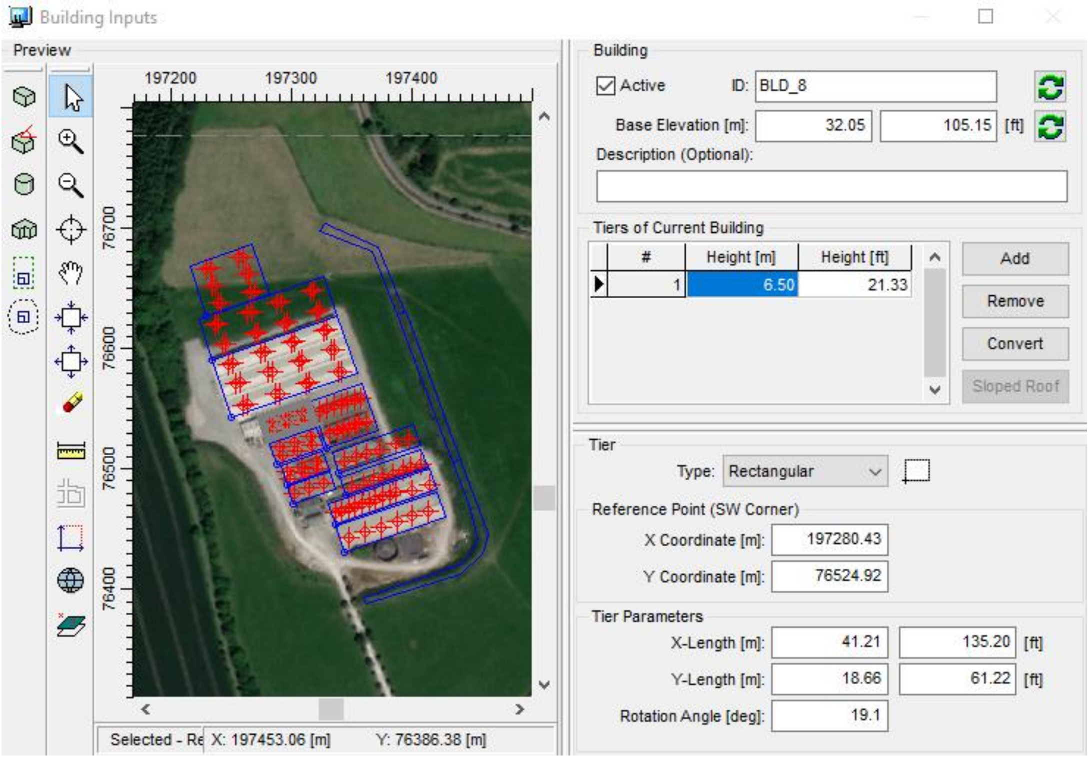

Building Inputs
Preview
197200
197300
197400
76700
76600
76500
76400
Selected - Re
Building
Active
ID: BLD_4
Base Elevation [m]: 31.99 104.95 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197339.56
Y Coordinate [m]: 76496.47
Tier Parameters
X-Length [m]: 71.19 233.56 [ft]
Y-Length [m]: 18.00 59.06 [ft]
Rotation Angle [deg]: 19.1


Building Inputs
Preview
197200
197300
197400
76700
76600
76500
76400
Selected - Re
Building
Active
ID: BLD_5
Base Elevation [m]: 31.96 104.86 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197301.99
Y Coordinate [m]: 76471.61
Tier Parameters
X-Length [m]: 36.93 121.16 [ft]
Y-Length [m]: 15.06 49.41 [ft]
Rotation Angle [deg]: 19.1

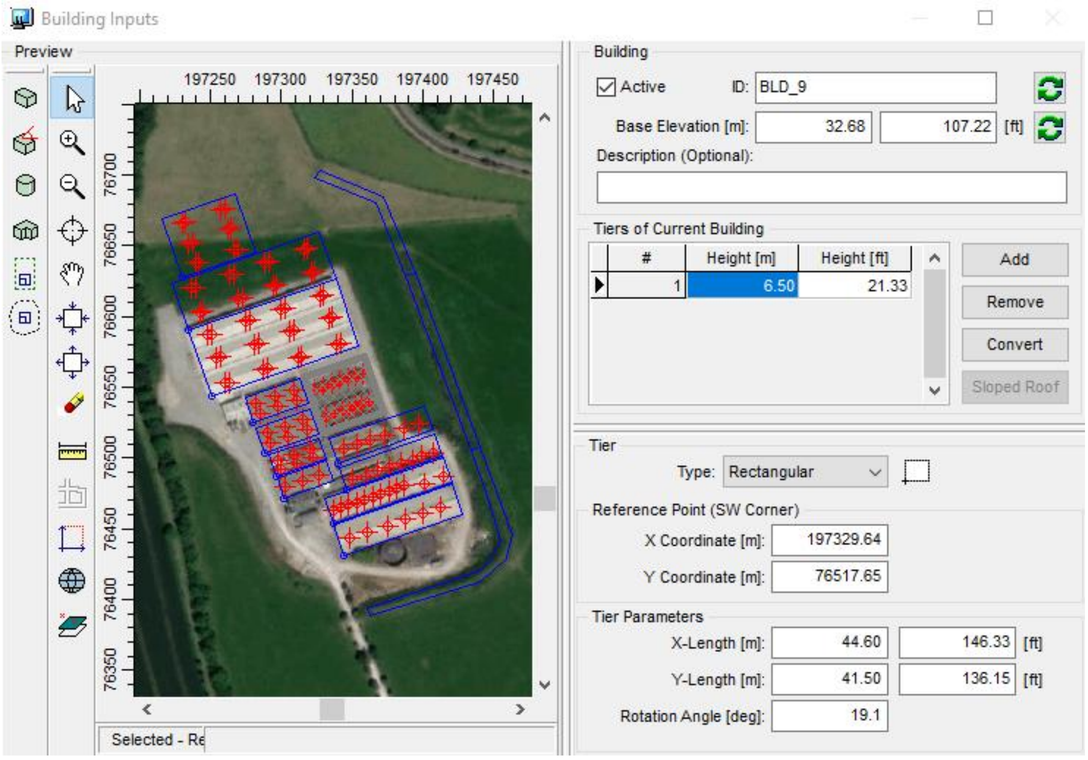

Building Inputs
Preview
197200
197300
197400
76700
76600
76500
76400
Selected - Re
Building
Active
ID: BLD_6
Base Elevation [m]: 32.00 104.99 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197296.64
Y Coordinate [m]: 76486.98
Tier Parameters
X-Length [m]: 36.70 120.41 [ft]
Y-Length [m]: 16.29 53.44 [ft]
Rotation Angle [deg]: 19.1

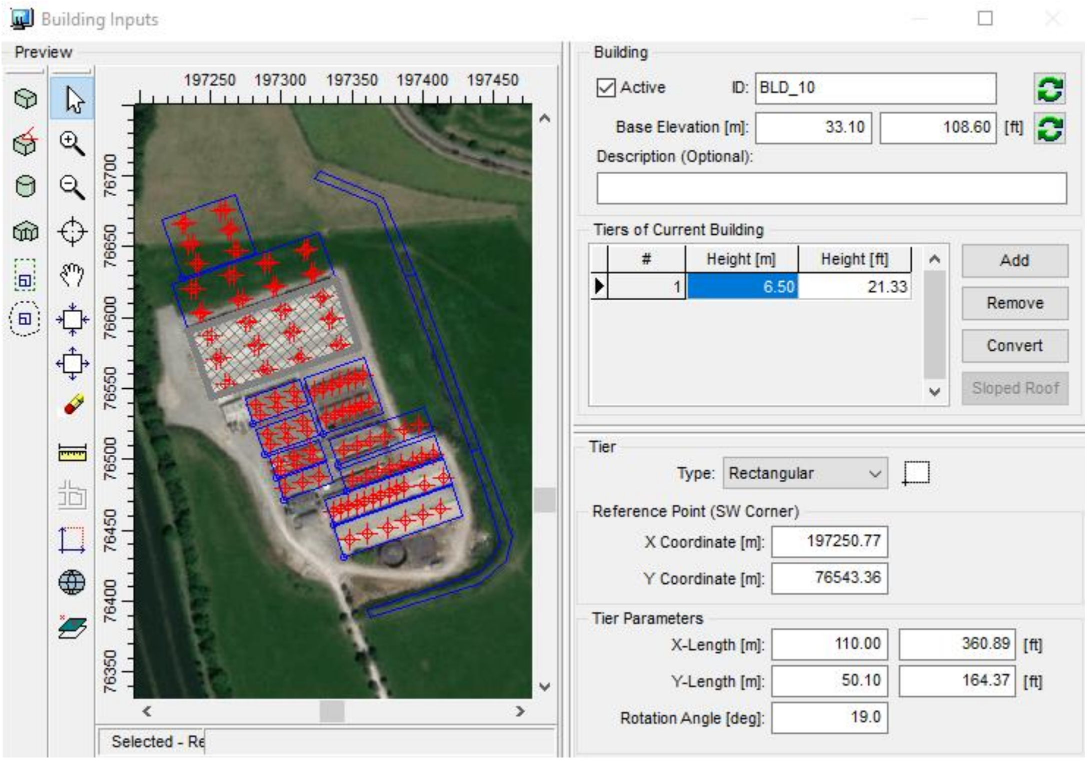


Building Inputs
Preview
197200
197300
197400
76700
76600
76500
76400
Selected - Re
Building
Active
ID: BLD_7
Base Elevation [m]: 32.00 104.99 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197287.79
Y Coordinate [m]: 76503.69
Tier Parameters
X-Length [m]: 41.21 135.20 [ft]
Y-Length [m]: 18.66 61.22 [ft]
Rotation Angle [deg]: 19.1



Building Inputs
Preview
197200
197300
197400
76700
76600
76500
76400
Selected - Re X: 197453.06 [m] Y: 76386.38 [m]
Building
Active
ID: BLD_8
Base Elevation [m]: 32.05 105.15 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197280.43
Y Coordinate [m]: 76524.92
Tier Parameters
X-Length [m]: 41.21 135.20 [ft]
Y-Length [m]: 18.66 61.22 [ft]
Rotation Angle [deg]: 19.1

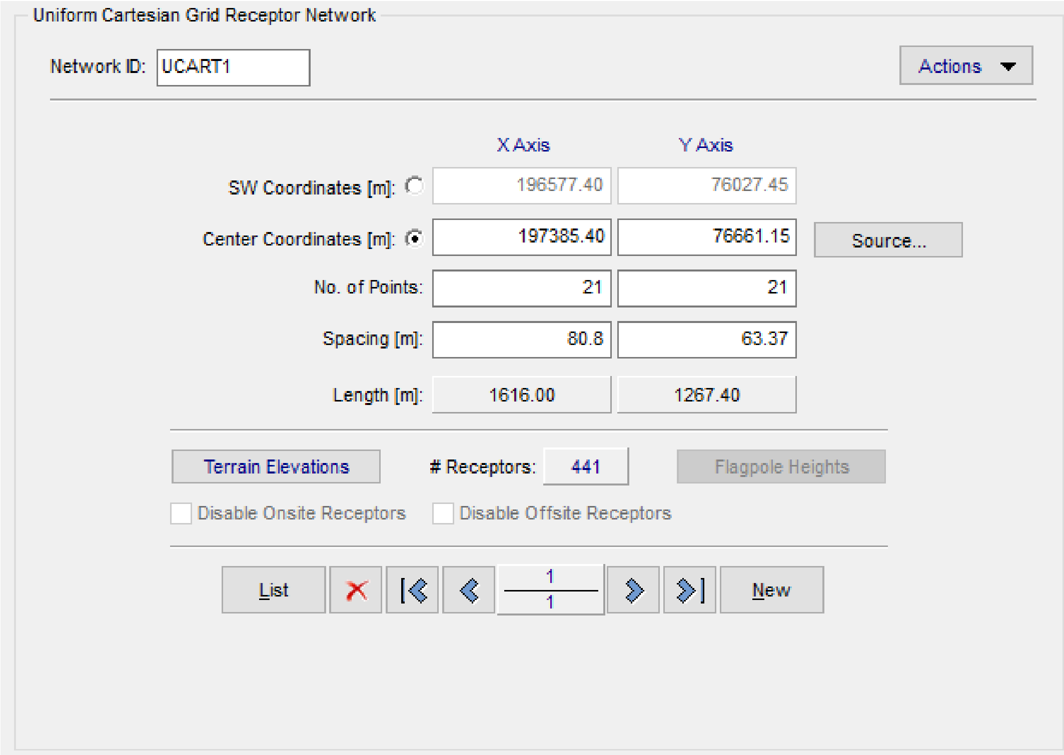

Building Inputs
Preview
Building
Active
ID: BLD_9
Base Elevation [m]: 32.68 107.22 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197329.64
Y Coordinate [m]: 76517.65
Tier Parameters
X-Length [m]: 44.60 146.33 [ft]
Y-Length [m]: 41.50 136.15 [ft]
Rotation Angle [deg]: 19.1
Selected - Re


Building Inputs
Preview
Building
Active
ID: BLD_10
Base Elevation [m]: 33.10 108.60 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197250.77
Y Coordinate [m]: 76543.36
Tier Parameters
X-Length [m]: 110.00 360.89 [ft]
Y-Length [m]: 50.10 164.37 [ft]
Rotation Angle [deg]: 19.0
Selected - Re

It can be seen from the Figures above that the building locations input in the model reflect a rotation angle of approximately 19 degrees.

It should be noted that the slurry tanks included in the assessment to the south of the site do not appear on the preview tab in each of the Figures above, but they are included in the AERMOD model.

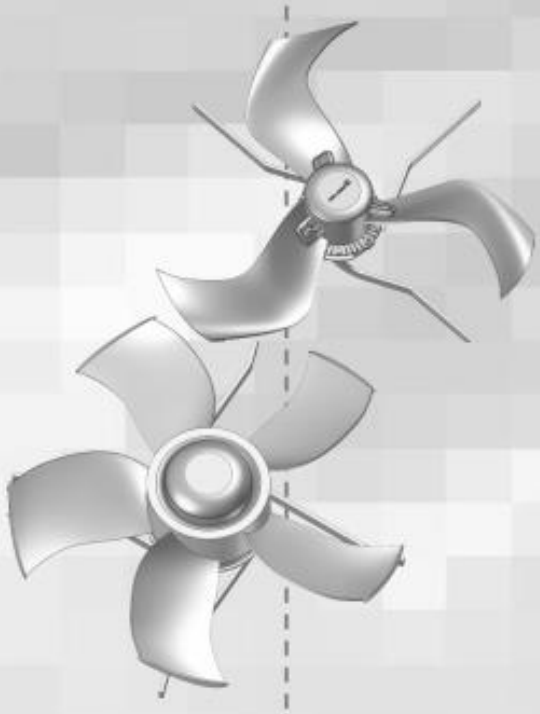
Figure 3: Details of Uniform Cartesian Grid



APPENDIX C TECHNICAL SPECIFICATION

Fans

Technical Info



2015.04.07 • 604061

SKOV

3 Technical Data

3.1 DA 600 LPC

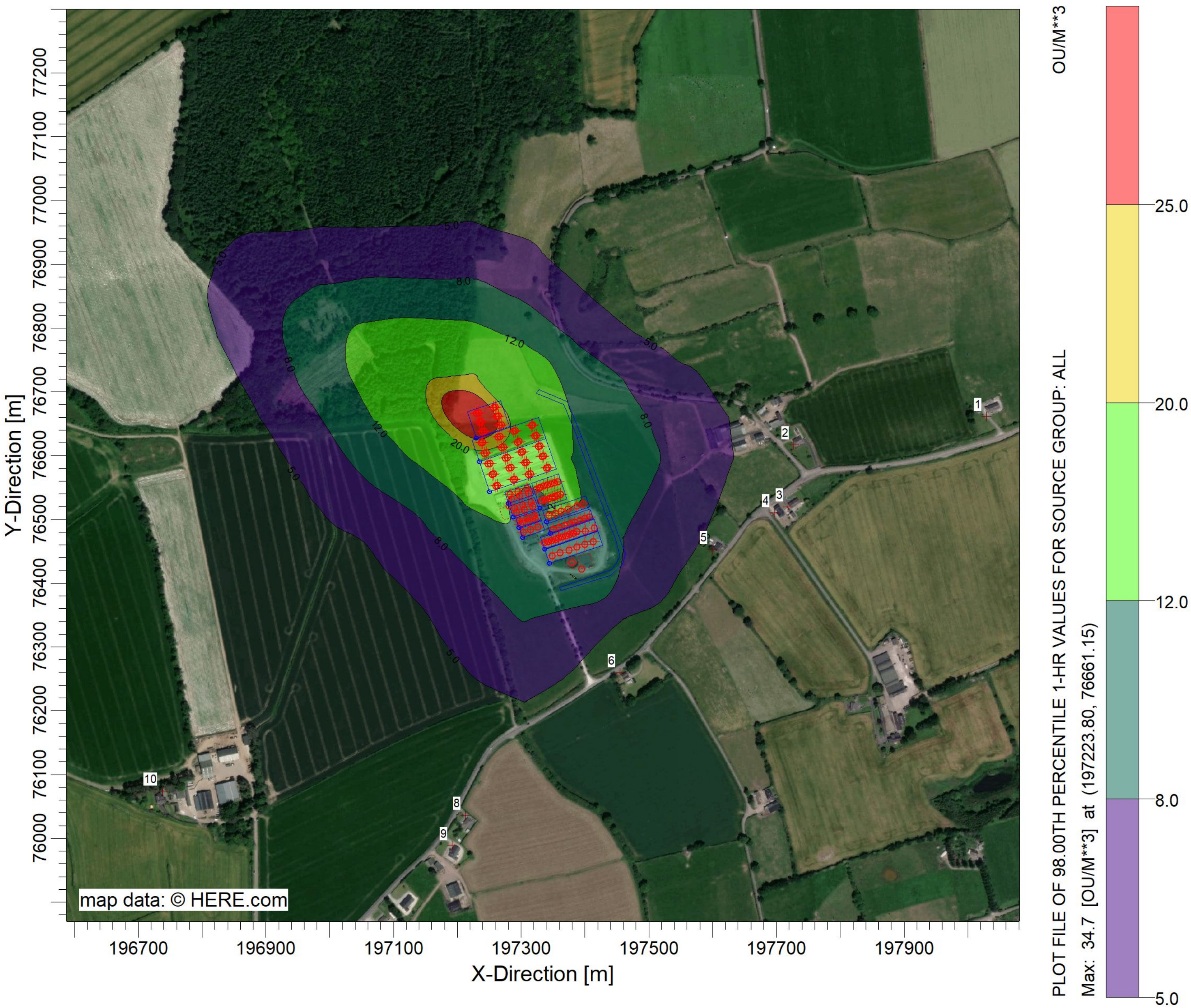
Fan type	445091/445092 DA 600 LPC-11	445086/445087 DA 600 LPC-12	445088/445089 DA 600 LPC-13
Electric			
Voltage [V]	230 -10 % / +15%	230 -10 % / +15%	230 -10 % / +15%
Frequency [Hz]	50/60	50/60	50/60
Motor current [A] (for Motor relay)	4.2	4.2	4.2
Power [W]	800	800	800
Adjustment ability	Adjustable	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:

Eoin O'Brien Pigs
98th Percentile of Max 1-Hour Ground Level Odour Concentration (ou/m3) (2020)



COMMENTS:

SOURCES:
122

RECEPTORS:
451

OUTPUT TYPE:
Concentration

MAX:
34.7 OU/M3**

MODELER:
Christy Carr

DATE:
23/01/2023

SCALE: 1:9,743

0 0.3 km

IRWIN CARR CONSULTANTS

PROJECT NO.:
2020191

AERMOD View - Lakes Environmental Software