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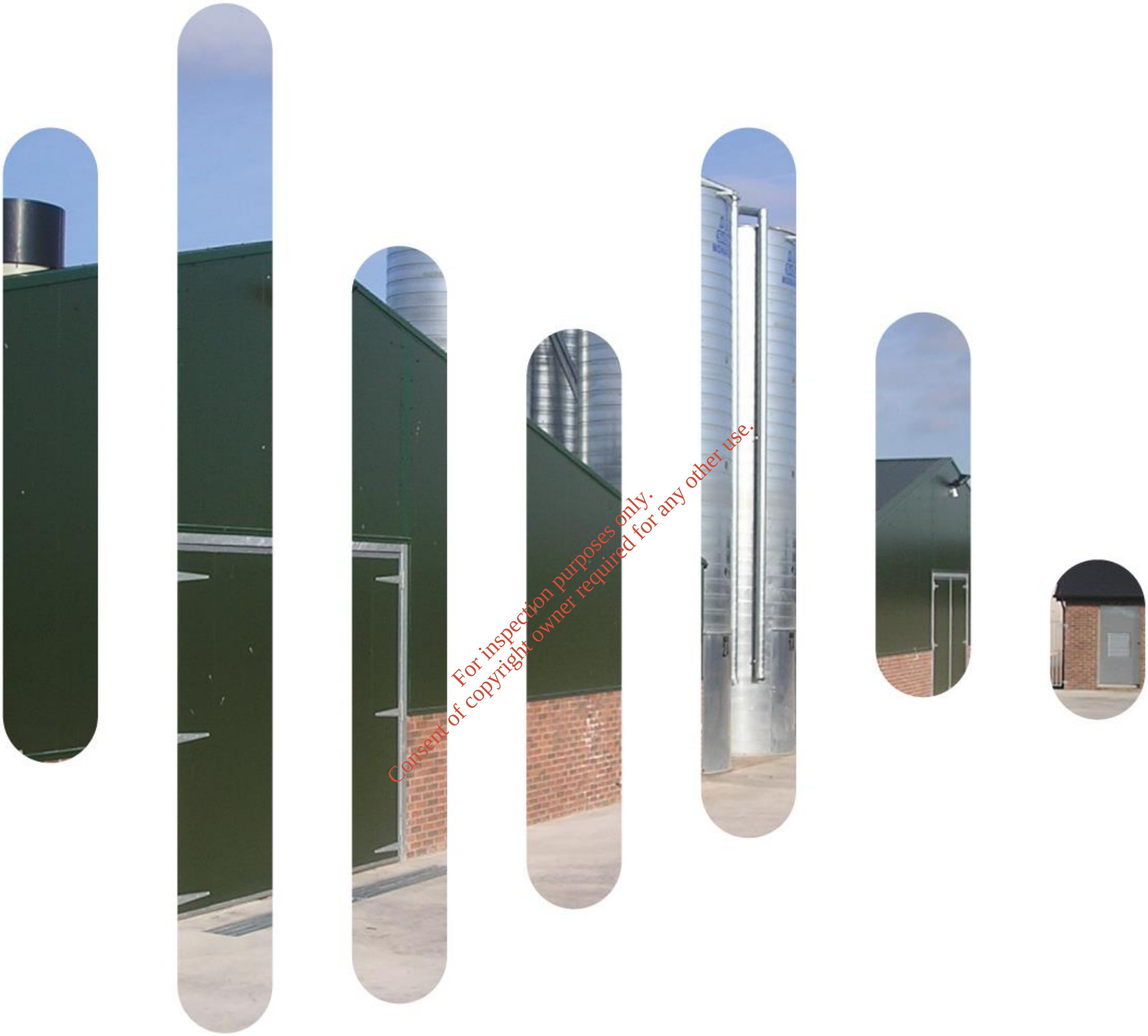

AMMONIA IMPACT ASSESSMENT
EOIN O'BRIEN PIGS

Rp 001 2020191 (Eoin O'Brien Pigs- Ammonia)
30 March 2021

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 001 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 existing pig farm at Mogeely, Co. Cork.

The purpose of this report is to quantify the ammonia and nitrogen levels at the ecologically sensitive areas 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 ammonia impact from the site, all 16 sheds have been included as part of this assessment as well as 2 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.

2 ASSESSMENT CRITERIA

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

2.1 Ammonia

There are limitations on emissions of ammonia from such installations for the protection of vegetation. They are referenced from *Cape, J.N.; van der Eerden, L.J.; Sheppard, L.J.; Leith, I.D.; Sutton, M.A.. 2009. Evidence for changing the critical level for ammonia. Environmental Pollution, 157 (3). 1033-1037.*

Where the limits are applied to general vegetation such as herbaceous species or forest trees the limit is set at 3 ± 1 μg/m³ of ammonia (ie. 2-4 μg/m³) as a long-term (several year) concentration.

For particularly sensitive plants such as lichens and bryophytes, the limit of 1 μg/m³ is applied to ammonia as a long-term (several year) concentration

Table 1 shows the target levels for the protection of vegetation.

Table 1: Ammonia limit values

Pollutant	Reason	Guideline Value	Measured as
Ammonia	Protection of Vegetation	1-3 μg/m³	Annual Mean

2.2 Nitrogen Deposition

Critical load values for nutrient nitrogen deposition are provided by the United Nations Economic Commission for Europe (UNECE) as a range (e.g. 10-20 kg N/ha/yr for dry heaths). This table provides indicative values within the critical load range, by habitat type, for use in detailed impact assessments in Ireland.

Table 2: Critical Load Range for atmospheric Nitrogen

Habitat type (EUNIS code)	Critical load (CL) range (kgN/ha/yr)	Value to use at screening stage (kgN/ha/yr)	Recommended value to use at detailed assessment stage (kgN/ha/yr)
Marine habitats			
Mid-upper saltmarshes (A2.53)	20-30	20	20
Pioneer & low-mid saltmarshes (A2.54 and A2.55)	20-30	30	30
Coastal habitats			
Shifting coastal dunes (B1.3)	10 to 20	10	10
Coastal stable dune grasslands (grey dunes) (B1.4)	8 to 15	8	Acid dunes = 8 Calcareous dunes = 10
Coastal dune heaths (B1.5)	10 to 20	10	10
Moist to wet dune slacks (B1.8)	10 to 20	10	Low base availability = 10 High base availability = 15
Inland surface waters			
Softwater lakes (permanent oligotrophic waters) (C1.1)	3 to 10	Seek site specific advice	
Dune slack pools (permanent oligotrophic waters) (C1.16)	10 to 20	10	10

Permanent dystrophic lakes, ponds and pools (C1.4)	3 to 10	Seek site specific advice	
Mire, bog and fen habitats			
Raised & blanket bogs (D1)	5 to 10	5	Apply guidance
Valley mires, poor fens and transition mires (D2)	10 to 15	10	10
Rich fens (D4.1)	15 to 30	15	15
Montane rich fens (D4.2)	15 to 25	15	15
Grasslands and tall forb habitats			
Sub-atlantic semi-dry calcareous grassland (E1.26)	15 to 25	15	15
Non-Mediterranean dry acid and neutral closed grassland (E1.7)	10 to 15	10	10
Inland dune pioneer grasslands (E1.94) Inland dune siliceous grassland (E1.95)	8 to 15	8	Acid dunes = 8 Calcareous dunes = 10
Low and medium altitude hay meadows (E2.2)	20 to 30	20	20
Mountain hay meadows (E2.3)	10 to 20	10	10
Moist & wet oligotrophic grasslands:			
Molinia caerulea meadows (E3.51)	15 to 25	15	15
Heath (Juncus) meadows & humid (Nardus Stricta) swards (E3.52)	10 to 20	10	10
Moss & lichen dominated mountain summits (E4.2)	5 to 10	5	7
Alpine and subalpine acid grasslands (E4.3) Alpine and subalpine calcareous grasslands (E4.4)	5 to 10	5	5
Heathland, scrub & tundra			
Arctic, alpine and subalpine scrub habitats (F2)	5 to 15	5	5
Northern wet heaths (F4.11) Dry heaths (F4.2)	10 to 20	10	10
Forest habitats (general)			
Use if not one of specific forests in section below			
Broadleaved woodland (G1)	10 to 20	10	10
Coniferous woodland (G3)	5 to 15	5	10 (Use 5 if lichens/free-living algae important features of the site).
Forest habitats (specific)			
Fagus woodland (beech) (G1.6)	10 to 20	10	15
Acidophilous Quercus-dominated woodland (oak) (G1.8)	10 to 15	10	10

Meso- and eutrophic Quercus woodland (G1.A)	15 to 20	15	15
Pinus sylvestris woodland south of the taiga (G3.4)	5 to 15	5	12
Coniferous woodland (G3)	5 to 15	5	10 (Use 5 if lichens/free-living algae important features of the site).

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 3 and 3 below gives general details of the pig houses.

Table 3: Dimensions of Pig Houses

	Dimensions	Total No. of Pigs	Efflux Temp	Emissions
Shed 1	88.4m x 22.8m x 6.5m	525 x Dry Sows	20 ºC	Mechanically Ventilated
Shed 2	88.7m x 18.8m x 6.5m	225 x Farrowing	20 ºC	Mechanically Ventilated
Shed 3	71.2m x 16.3m x 6.5m	225 x Farrowing	20 ºC	Mechanically Ventilated
Shed 4	71.2m x 18m x 6.5m	525 x Dry Sows	20 ºC	Mechanically Ventilated
Shed 5	36.9m x 15.1m x 6.5m	1,500 x Weaners	20 ºC	Mechanically Ventilated
Shed 6	36.7m x 16.3m x 6.5m	1,500 x Weaners	20 ºC	Mechanically Ventilated
Shed 7	41.2m x 18.7m x 6.5m	1,500 x Weaners	20 ºC	Mechanically Ventilated
Shed 8	41.2m x 18.7m x 6.5m	1,500 x Weaners	20 ºC	Mechanically Ventilated
Shed 9	43.5m x 18.6m x 6.5m	1,500 x Weaners	20 ºC	Mechanically Ventilated
Shed 10	43.5m x 18.6m x 6.5m	1,500 x Weaners	20 ºC	Mechanically Ventilated

Table 4: Dimensions of Fattening Sheds

	Dimensions	Total No. of Pigs per Shed	Efflux Temp	Emissions
Shed 11 – 15	109.9m x 15m x 6.5m	600 x Growers 900 x Fatteners*	20 °C	Mechanically Ventilated
Shed 16	55m x 43.3m x 6.5m	600 x Growers 900 x Fatteners 410 x Maiden Gilts (incl. 10 x Boars)	20 °C	Mechanically Ventilated

**These animal numbers relate to the total number of pigs per shed. A total of 9,410 pigs have been included in sheds 11 - 16.*

It can be seen from the Table above that sheds 11 - 16 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 ammonia, is best quantified as an emission rate.

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

3.2.3 LOW PROTEIN DIET

It is accepted throughout the intensive agriculture industry, through robust scientific evidence, that a reduction in crude protein in animal feed, will lead to a reduction in ammonia emissions from livestock. There is also evidence to show that as ammonia from animals is decreased.

There are a number of recent scientific studies that have been carried out, and subsequent documents produced, in relation to the ammonia emissions from pig houses and the impact of mitigation measures associated with Best Available Techniques (BAT).

The recent EU CID[3] states that one of the ways in which to reduce total nitrogen excreted, and consequently ammonia emissions, is to reduce the crude protein content of the pig feed.

This statement is supported by a peer review report which has been prepared by Hayes et al[4], which cites Kay and Lee[5]:

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

Table 5 below summarises the level of reduction which are included in the conclusions of these reports applicable to this site:

Table 5: Effect of mitigation measures

Crude Protein in feed
Each 1% reduction in CP in the range 20-12% results in a 10% reduction in ammonia emission levels

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 ammonia reduction of 30% has been applied to the sheds on site.

Table 6 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.

Table 6: Ammonia Emission Factors

Category of Animal	Source Levels (kg/yr/animal)	Low Protein Reduction	Levels after Reductions (kg/yr/animal)
Dry Sows	3.01	30%	**2.11**
Growers	1.59		**1.11**
Fatteners/ Maiden Gilts	4.14		**2.90**
Farrowing Sows	5.84		**4.09**

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

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[3] *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. Pg 7*

[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*

3.2.4 REGULAR REMOVAL OF SLURRY

The emission factors for pigs have been outlined in Guidance published by the Environment Agency[6], which is used to inform the emission factors detailed in the SCAIL[7] screening tool/ reference report.

There are various housing systems included in the document and the Table below details some the emission factors associated with the housing system on this site, which are compared to standard emissions for a Fully Slatted Floor (FSF).

Table 7: Source Ammonia Emission Factors for Regular Removal of Slurry

Category of Animal	Baseline Emissions for FSF (kg/yr/animal)	Housing Type	Source Levels (kg/yr/animal)	Reduction
Sows	3.01	Fully Slatted Floor (FSF) with vacuum system for frequent slurry removal	2.26	25%
Fatteners	4.14		3.11	25%
Weaners	0.29		0.22	25%

It can be seen from the Table above that the housing systems which accounts for the frequent removal of slurry (in line with the Best Available Techniques (BAT) Reference Document) results in a 25% reduction in ammonia emissions, when compared to the baseline emission factor for a fully slatted floor.

The emission factors included in Table 6 above, which already take account of a low protein diet, have been corrected in the Table below to account for the regular removal of slurry on site.

Table 8 below shows the category of animal and recommended emission factors per animal applicable to this project, based on the regular removal of slurry and a feed crude protein content of 16%.

Table 8: Final Ammonia Emission Factors

Category of Animal	Housing Type	Levels after Low Protein Diet (kg/yr/animal)	Regular Removal of Slurry Reduction	Levels after Reductions (kg/yr/animal)
Dry Sows	Fully Slatted Floor (FSF) with vacuum system for frequent slurry removal	2.11	25%	**1.58**
Growers		1.11		**0.83**
Fatteners/ Maiden Gilts		2.90		**2.17**
Farrowing Sows		4.09		**3.07**
Weaners		0.29		**0.22**

Table 9 below details the total emission rates per shed, based on the emission factors calculated above. The total emission rates are set as the pollutant leaving the building each second.

[6] *Pollution Inventory Reporting- Intensive Farming Guidance Note. Environment agency, January 2013, Version 5.*

[7] *SCAIL-Agriculture Update, Sniffer ER26: Final Report March 2014*

Table 9: Concentrations per Building

House No.	Animal Type (and Number)	Ammonia Emission Factor (kg/yr per animal)	Ammonia Emission Rate (kg/yr per animal type)	Ammonia Emission Rate (kg/yr per house)	Ammonia Emission Rate (g/s per house)
1	525 x Dry Sows	1.58	829.6	829.6	0.026
2	225 x Farrowing	3.07	689.9	689.9	0.022
3	225 x Farrowing	3.07	689.9	689.9	0.022
4	525 x Dry Sows	1.58	829.6	829.6	0.026
5 - 10	1,500 x Weaners	0.22	326.3	326.3	0.010
11 - 15	600 x Growers	0.83	500.9	2,457	0.078
	900 x Fatteners	2.17	1,956.2		
16	600 x Growers	0.83	500.9	3,348.1	0.106
	1,310 x Fatteners (incl. 400 x Gilts & 10 x Boars)	2.17	2,847.3		

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

Table 10: Emission Rates for each stack

House No.	Ammonia Emission Rate (g/s per house)	No of Fans (and type)	Ammonia per fan (g/s)
1	0.026	3 x BD-FF063 6DT	**0.0039**
		3 x BD-FF063 Zit (S)	**0.0049**
2	0.022	12 x Skov DA600	**0.0018**
3	0.022	4 x BD-FF063 6DT	**0.0024**
		4 x BD-FF063 Zit (S)	**0.0030**
4	0.026	3 x BD-FF063 6DT	**0.0039**
		3 x BD-FF063 Zit (S)	**0.0049**
5	0.010	3 X Skov DA600	**0.0034**
6	0.010	3 x BD-FF063 6DT	**0.0015**
		3 x BD-FF063 Zit (S)	**0.0019**
7	0.010	6 X Skov DA600	**0.0017**
8	0.010	6 X Skov DA600	**0.0017**
9	0.010	7 x BD-FF063 Zit (S)	**0.0015**
E0	0.010	7 x BD-FF063 Zit (S)	**0.0015**
11 - 15	0.079	8 x BD-FF091	**0.0097**
16	0.092	12 x BD-FF091	**0.0088**

3.2.5 STACK EMISSIONS VELOCITY

There are four types of fan on the site, Table 11 below shows the ventilation rates for the chosen fan types.

Table 11: 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 specification of this fan is provided in Appendix C.*

3.2.6 SLURRY STORAGE

Two covered slurry lagoons with rigid covers have also been included as part of this assessment. Table 12 below shows the ammonia emissions from the lagoons, taking into account the rigid covers.

Table 12: Concentrations per Building

Source	Area (m^2)	Cover	Emission Factor ($kg/m^2/yr$)	Total Emissions (kg/yr)	Total Emissions (g/s)
Overground Slurry Tank	255	Rigid Cover	0.28	71.4	**0.0023**
Covered Slurry Tank	380	Rigid Cover	0.28	106.4	**0.0034**

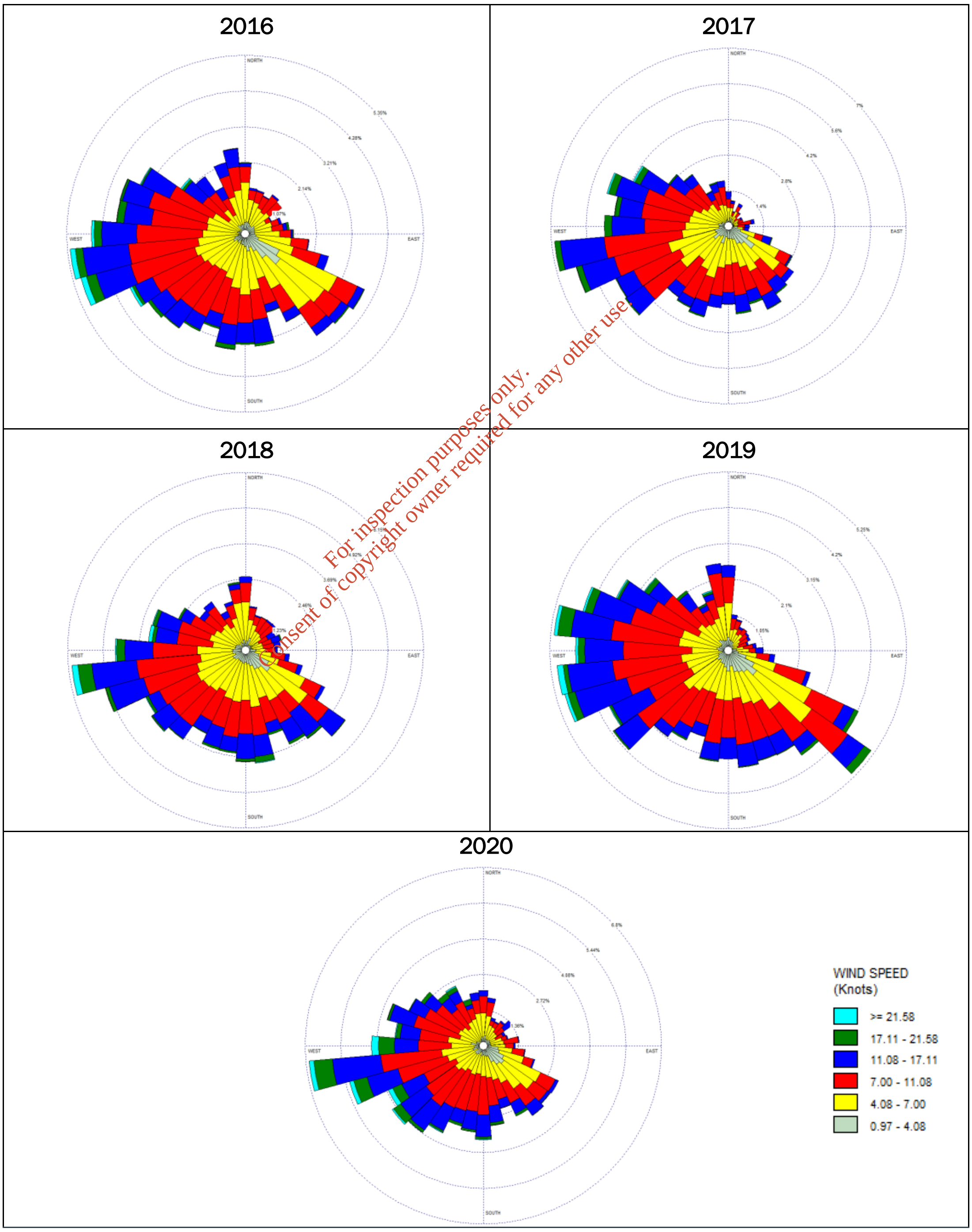
The emissions above detail the total ammonia leaving each of the tanks each second.

3.3 Meteorological Data

Five years of hourly sequential meteorological data was used for the AERMOD dispersion modelling assessment. It is noted that the annual mean wind speed at the source location is approx. 6m/s, as shown on the MET Eireann website[8]. It can also be seen from the average wind speed at Shannon Airport is approx. 5.5m/s.

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 windrose data for each individual year is presented in Figure 1 below.

Figure 1: Annual Windrose Data- Shannon Airport



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

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 AMMONIA

The ammonia levels were assessed in areas of specific interest in relation to vegetation.

All areas within approximately 7.5km of the site were searched on the EPA website for the four types of designated areas listed below:

- **Special Areas of Conservation (SAC)**

  These areas are given special protection under the European Union's Habitats Directive to protect some of the most seriously threatened habitats and species across Europe.

- **Special Protection Areas (SPA)**

  Areas designated under the European Commission on the conservation of wild birds (the Birds Directive). All EU member states are required to identify internationally important areas for breeding, over-wintering and migrating birds and designate them as SPA's.

- **Natural Heritage Area (NHA)**

  This is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection.

- **Proposed Natural Heritage Area (pNHAs)**

  These proposed sites are of significance for wildlife and habitats. The pNHAs cover approximately 65,000ha and designation will proceed on a phased basis over the coming years.

There were seven designated sites located within 15km of the pig sheds which are shown in Table 13 below.

Table 13: Designated areas in vicinity of the site

Location	Description	Approx. distance to shed (km)	ING Grid Co-ordinates	
1	Ballymacoda Bay SPA	7.89	204677	73692
2	Ballymacoda (Clonpriest and Pillmore) SAC	8.02	204418	72809
3	Ballycotton Bay SPA	9.44	200203	67549
4	Great Island Channel SAC	9.94	188538	71890
5	Cork Harbour SPA	9.96	188510	71890
6	Blackwater River (Cork/Waterford) SAC	10.72	207412	80146
7	Blackwater Estuary SPA	10.79	207488	80164

Ammonia modelling was carried out for each individual year with the results at the nearest identified locations presented in Table 14 below. All results are the Ammonia concentration in µg/m^3.

Table 14: Annual Average Ammonia Concentrations at Identified locations

Location	2015	2016	2017	2018	2019	Average
1	0.012	0.015	0.013	0.013	0.014	**0.013**
2	0.013	0.013	0.014	0.011	0.013	**0.013**
3	0.010	0.012	0.011	0.011	0.011	**0.011**
4	0.010	0.006	0.009	0.008	0.009	**0.009**
5	0.010	0.006	0.009	0.008	0.009	**0.009**
6	0.011	0.014	0.011	0.007	0.011	**0.011**
7	0.011	0.013	0.011	0.007	0.010	**0.010**

All of the predicted Ground Level Concentrations of ammonia detailed in the Tables above are significantly below the limit values as provided in Table 1 in relation to the protection of vegetation.

4.1 Results

Table 15 below compares the highest annual average predicted levels at the designated areas where:

- The Process contribution (PC), the maximum modelled concentration of the substance due to process emissions alone.
- Predicted Environmental Concentration (PEC) – that is, the maximum modelled concentration (of ammonia) due to process emissions combined with estimated baseline concentrations.
- PC and PEC as a percentage of the objective or guideline.

For the assessment of annual mean concentrations, the annual mean contribution of the process can be added to the annual mean estimate for background.

Table 15: Ammonia concentration at EPA designated ecologically sensitive location from pig sheds

	Location	Guideline (µg/m-3)	Background (µg/m-3)	Highest PC (µg/m-3)	PEC (µg/m-3)	PC/ Guideline level (%)	PEC/ Guideline level (%)
1	Ballymacoda Bay SPA	3	1.01	0.015	1.025	**0.5**	34
2	Ballymacoda (Clonpriest and Pillmore) SAC	3	1.00	0.014	1.014	**0.5**	34
3	Ballycotton Bay SPA	3	1.00	0.012	1.012	**0.4**	34
4	Great Island Channel SAC	3	0.76	0.010	0.770	**0.3**	26
5	Cork Harbour SPA	3	0.76	0.010	0.770	**0.3**	26
6	Blackwater River (Cork/Waterford) SAC	1	1.17	0.014	1.184	**1.4**	118
7	Blackwater Estuary SPA	3	1.17	0.013	1.183	**0.4**	39

The ammonia concentrations at the sites are dominated by the background concentrations, which are approximately 34– 118% of the air quality guideline for ammonia.

At all locations the deposition of ammonia is <4% and therefore considered to be insignificant.

It can also be seen from the Table above that the guideline level (critical level) of ammonia is not exceeded at 6 of the 7 sites (Locations 1– 5 and 7).

At the one site where the Critical Level of ammonia is exceeded (Location 6), the PC of the site is 1.4% of the Guideline level, and as a result considered insignificant for the purposes of this assessment.

5 CUMULATIVE ASSESSMENT

Within the EPA Guidance AG4[9], specific information is provided in relation to the consideration of Cumulative Impact Assessments.

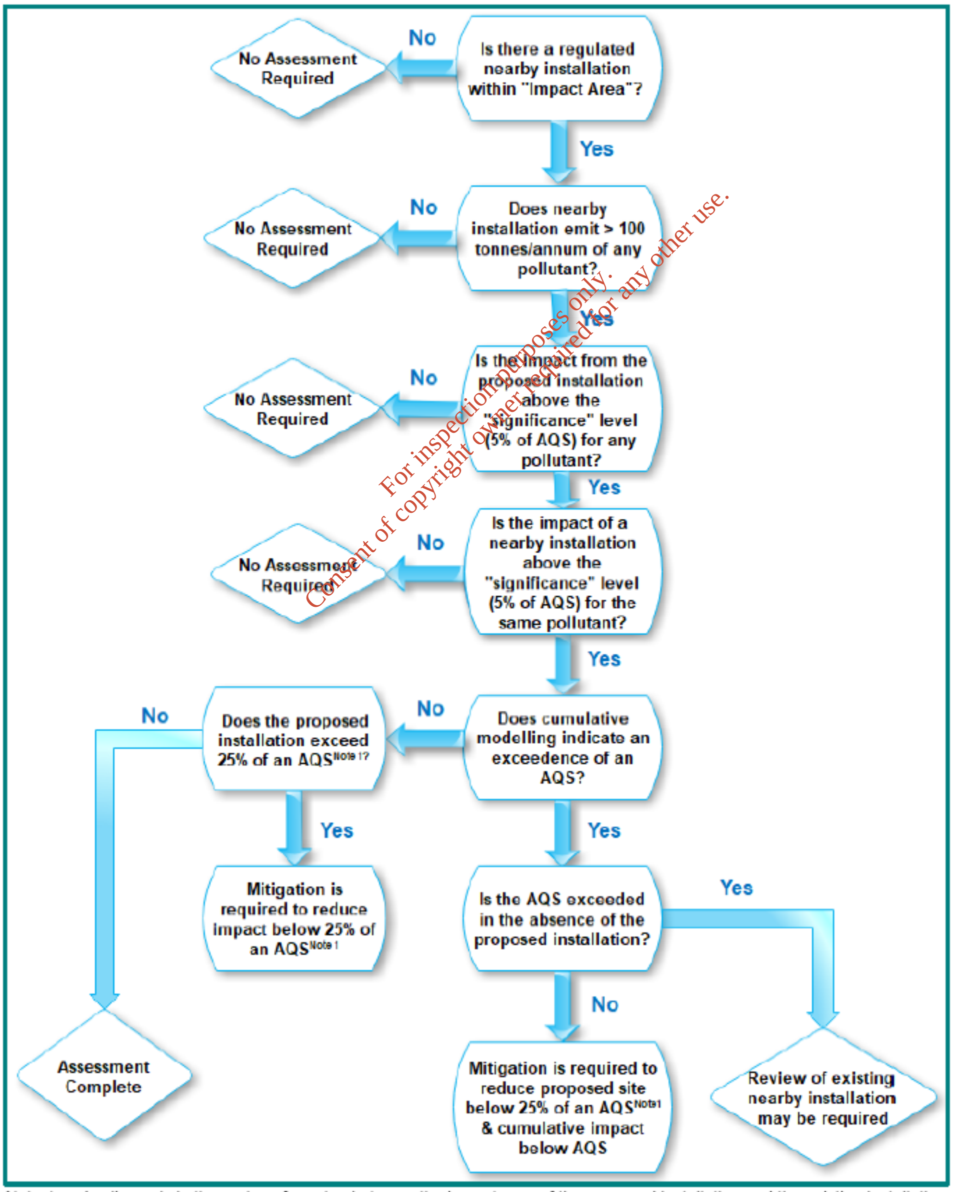
It is the purpose of a cumulative assessment to determine whether there is a significant impact at a designated site. The EPA have defined in their Guidance what is considered 'significant':

> *"'Significance', in an Irish context, for any pollutant may be defined as an impact leading to a 5% increase in the applicable ambient air quality standard (AQS)".*

In a recent consultation response, the EPA confirmed that for the assessment of impacts of intensive agriculture installations on Natura sites is typically 4% of the critical load limit for ammonia and 5% of the critical load limit for nitrogen.

Figure A2 of Appendix E shows a flowchart for undertaking a cumulative impact assessment of a nearby industrial installation, which is shown below:

Figure 2: Flowchart for undertaking a Cumulative Assessment of a nearby Industrial Installation.



Note 1: Applies only in the region of overlap between the impact area of the proposed installation and the existing installation.

[9] *Environmental Protection agency. Office of Environmental Enforcement (OEE). Air Dispersion Modelling from Industrial Installations Guidance Note (AG4). Appendix E*

The following points detail whether or not a cumulative assessment is necessary as part of this assessment.

- It is noted that option 3 of the flowchart states "Is the impact from the proposed installation above the 'significance' level (4% of AQS for ammonia) for the same pollutant?"

  It can be seen from Table 15 above that the maximum process contribution at the closest designated sites (Location 6- Blackwater River Cork/ Waterford) is 1.4%.

As a result, a cumulative assessment is not required for this site.

6 NITROGEN DEPOSITION

The Critical Load specifies the annual amount of ammonia that can be deposited for a given area per year. Below this level, sensitive habitat should not be affected.

The dry deposition flux (µg/m²/s of ammonia) was calculated using AQTAG06[10] where the predicted ground level of ammonia (in µg/m³) was multiplied by the relevant deposition velocity.

The dry deposition was then multiplied by the conversion factor provided in the guidance to convert to the levels of kgN/ha/yr. The conversion factors are provided in Table 8.1 and 8.2 of the AQTAG06 as presented in the Table 16 below.

Table 16: Conversion Factors

Pollutant	NH_3 Deposition Velocity (m/s)	Conversion Factor
NH_3 to N	0.02 (short vegetation)	260

Table 17 below converts the highest Process Contribution in µg/m^{-3} to kg.N/ha/yr, using the conversion factors detailed in Table 16 above.

Table 17: Conversion of Highest NH_3 Results

Location	Pollutant	Highest PC (µg/m^{-3})	NH_3 Deposition Velocity (m/s)	Conversion Factor	Highest PC (kg.N/ha/yr)
1	NH_3 to N	0.015	0.02 (short vegetation)	260	0.08
2		0.014			0.07
3		0.012			0.06
4		0.010			0.05
5		0.010			0.05
6		0.014			0.07
7		0.013			0.07

Using similar methodology to the ammonia assessment in Section 4 above the PC and PEC can be seen in Table 18 below.

[10] Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, AQTAG06

Table 18: Nitrogen concentration at designated ecologically sensitive locations

	Location	Guideline (kg N/ha/yr)	Background (kg N/ha/yr)	Highest PC (kg.N/ha/yr)	PEC (kg N/ha/yr)	PC/ Guideline level (%)	PEC/ Guideline level (%)
1	Ballymacoda Bay SPA	20	16.2	0.08	16.28	0.38	81
2	Ballymacoda (Clonpriest and Pillmore) SAC	20	16.2	0.07	16.27	0.35	81
3	Ballycotton Bay SPA	20	15.85	0.06	15.91	0.30	80
4	Great Island Channel SAC	20	16.55	0.05	16.60	0.27	83
5	Cork Harbour SPA	20	16.55	0.05	16.60	0.27	83
6	Blackwater River (Cork/Waterfo rd) SAC	5	27.13	0.07	27.20	1.41	544
7	Blackwater Estuary SPA	20	16.53	0.07	16.60	0.34	83

It can be seen from Table 20 that the nitrogen concentrations at the sites are dominated by the background concentrations.

The PC at all Locations is less than 0.1kg.N/ha/yr, and as a result would be considered deminimus for the purposes of the Nitrogen assessment.

7 CONCLUSIONS

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

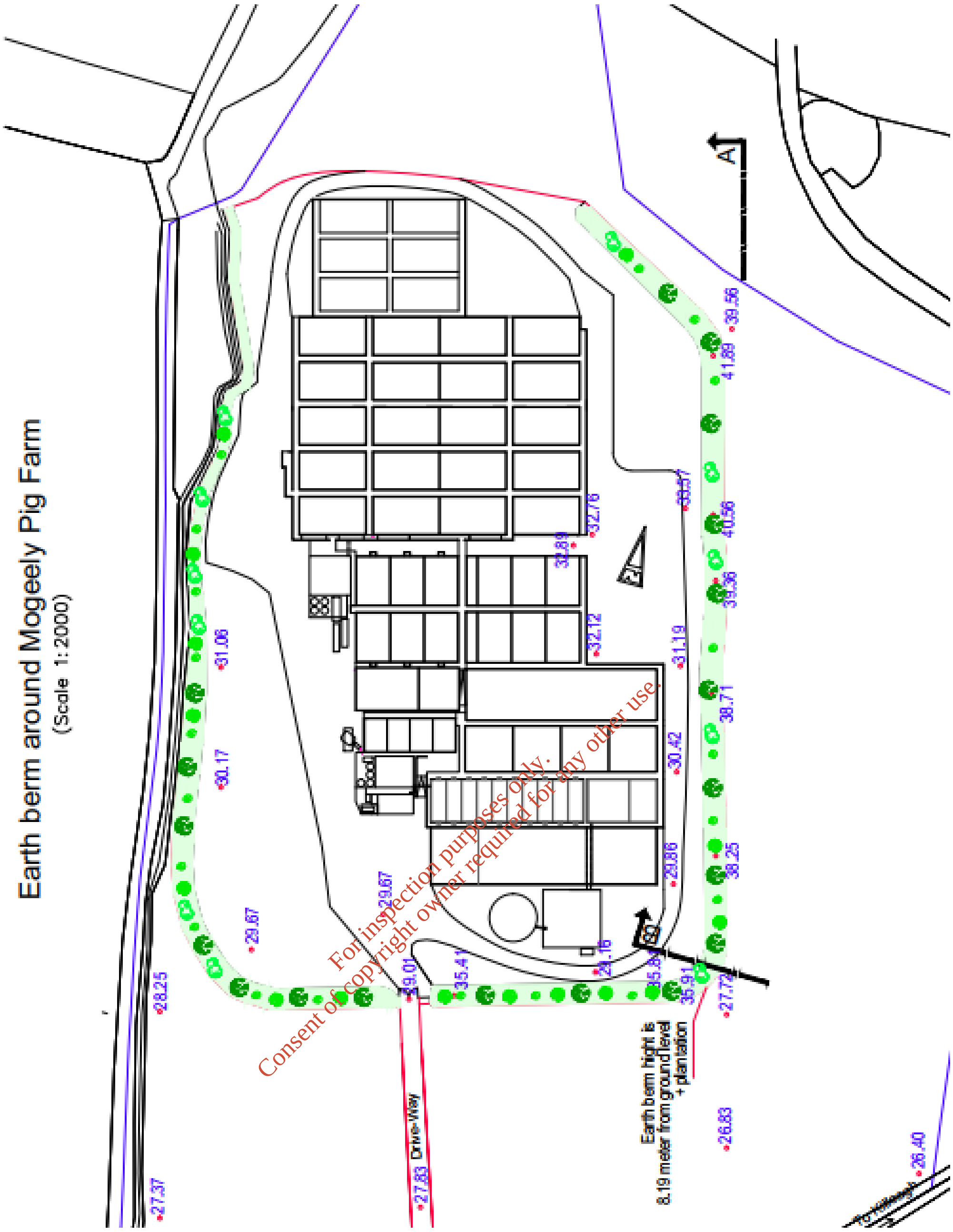
The predicted results of the ammonia modelling process show that the limits for the protection of vegetation are not exceeded at the designated habitats within the vicinity of the pig farm. Thus, any areas of ecological interest will not be adversely affected from the ammonia emissions for the operation of the farm.

Appendix D indicates the predicted dispersion of the ammonia plume for 2019 at 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 13 above.*

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


Earth berm around Mogeely Pig Farm
(Scale 1:2000)
Drive-Way
Earth berm hight is
8.19 meter from ground level
+ plantation

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 19: Building Location

Building Number	Irish Grid Co-ordinates (SW Corner)
1	197344 76431
2	197337 76454
3	197346 76478
4	197340 76496
5	197302 76472
6	197297 76487
7	197288 76504
8	197280 76525
9	197323 76538
10	197330 76518
11	197251 76543
12	197245 76560
13	197239 76576
14	197233 76593
15	197728 76610
16	197230 76628

Table 20: Source Locations

Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
1	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
2	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

Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
	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
3	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
4	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
5	1	C	7.1	197303	76480
	2	C	7.1	197315	76484
	3	C	7.1	197326	76488
6	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
7	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

Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
8	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
9	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
10	1	D	7.1	197324	76548
	2	D	7.1	197329	76550
	3	D	7.1	197336	76552
	4	D	7.1	197341	76554
	5	D	7.1	197347	76556
	6	D	7.1	197352	76557
	7	D	7.1	197357	76559
11	1	B	7.4	197260	76553
	2	B	7.4	197263	76554
	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
12	1	B	7.4	197254	76571
	2	B	7.4	197257	76572
	3	B	7.4	197281	76580
	4	B	7.4	197284	76581
	5	B	7.4	197306	76589
	6	B	7.4	197308	76590
	7	B	7.4	197333	76599

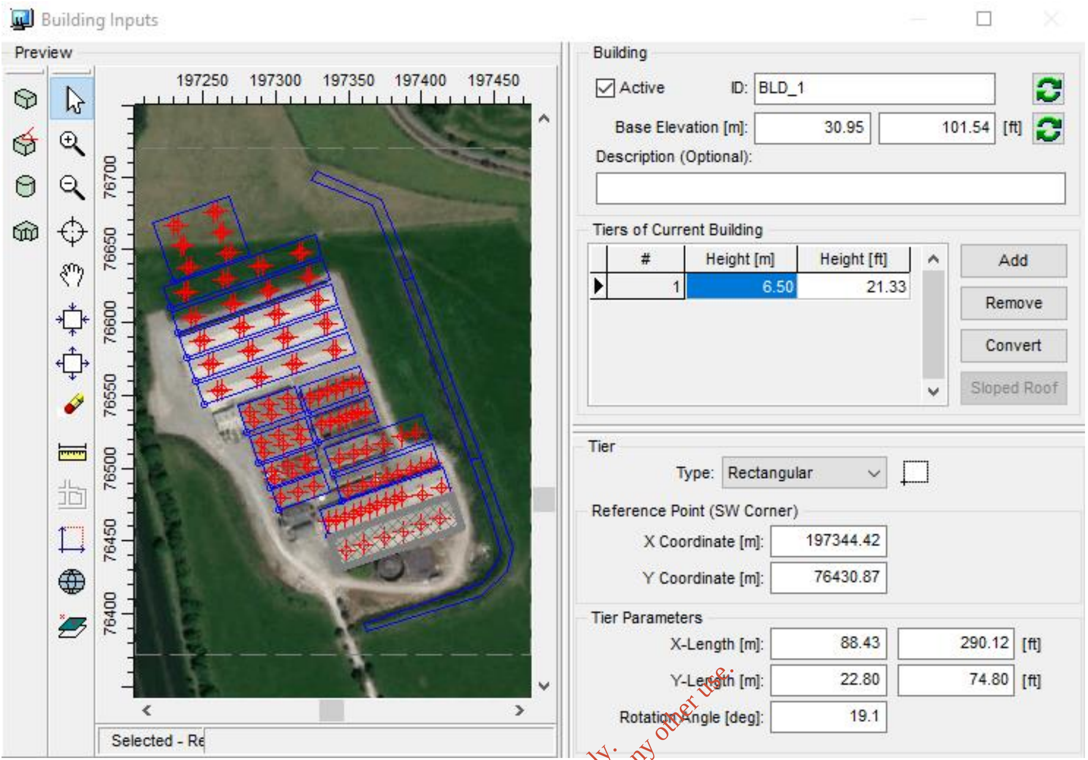
Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
	8	B	7.4	197336	76599
13	1	B	7.4	197248	76587
	2	B	7.4	197251	76588
	3	B	7.4	197275	76596
	4	B	7.4	197278	76597
	5	B	7.4	197300	76605
	6	B	7.4	197302	76606
	7	B	7.4	197327	76615
	8	B	7.4	197329	76615
14	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
15	1	B	7.4	197237	76620
	2	B	7.4	197240	76621
	3	B	7.4	197264	76629
	4	B	7.4	197267	76630
	5	B	7.4	197288	76638
	6	B	7.4	197291	76639
	7	B	7.4	197316	76648
	8	B	7.4	197318	76648
16	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

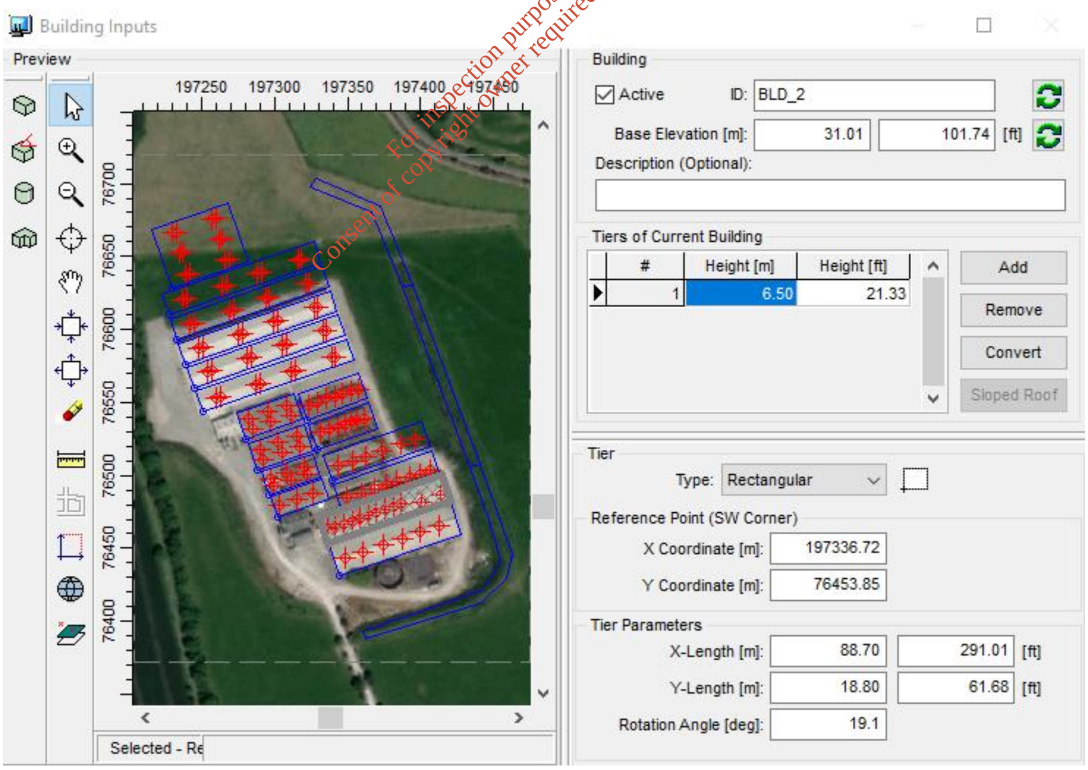
Building Number	Source	Source Type*	Release Height (m)	Approx. Irish Grid Co-ordinates (to the nearest 1m)	
	11	B	7.4	197257	76675
	12	B	7.4	197260	76676

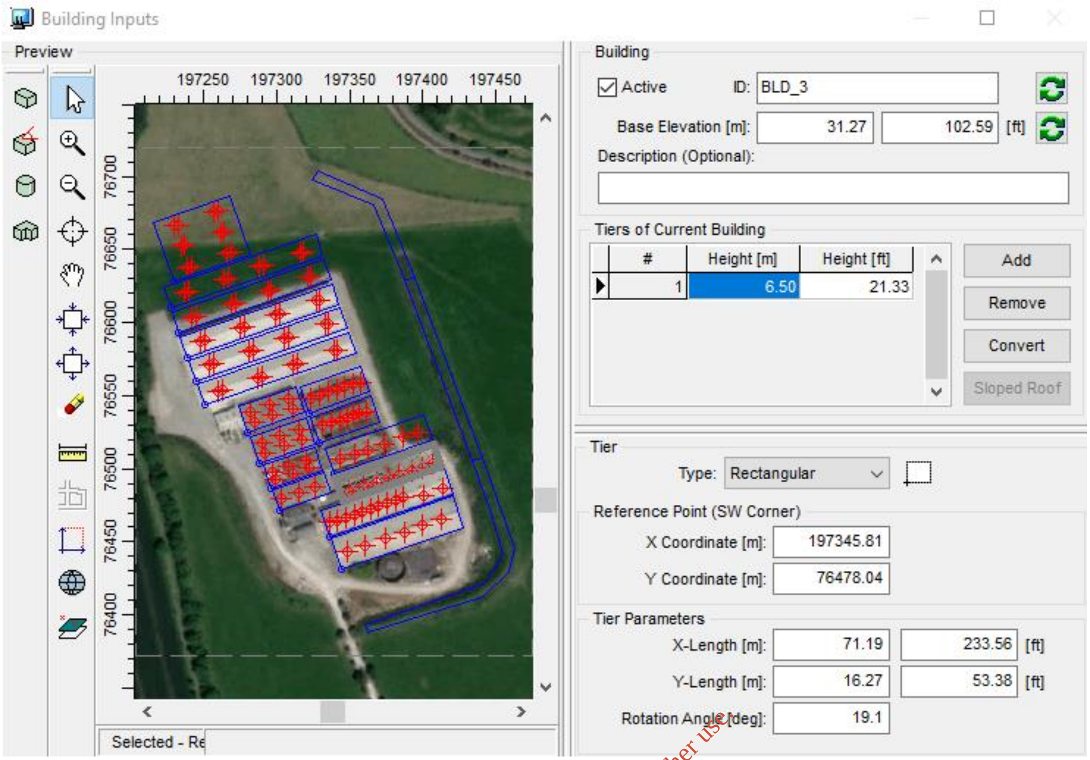
Details of each source type are provided in Table 11 above and summarised below:

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

Figure 3: Building Inputs of Sheds






Building Inputs
Preview
197250 197300 197350 197400 197450
76700 76650 76600 76550 76500 76450 76400
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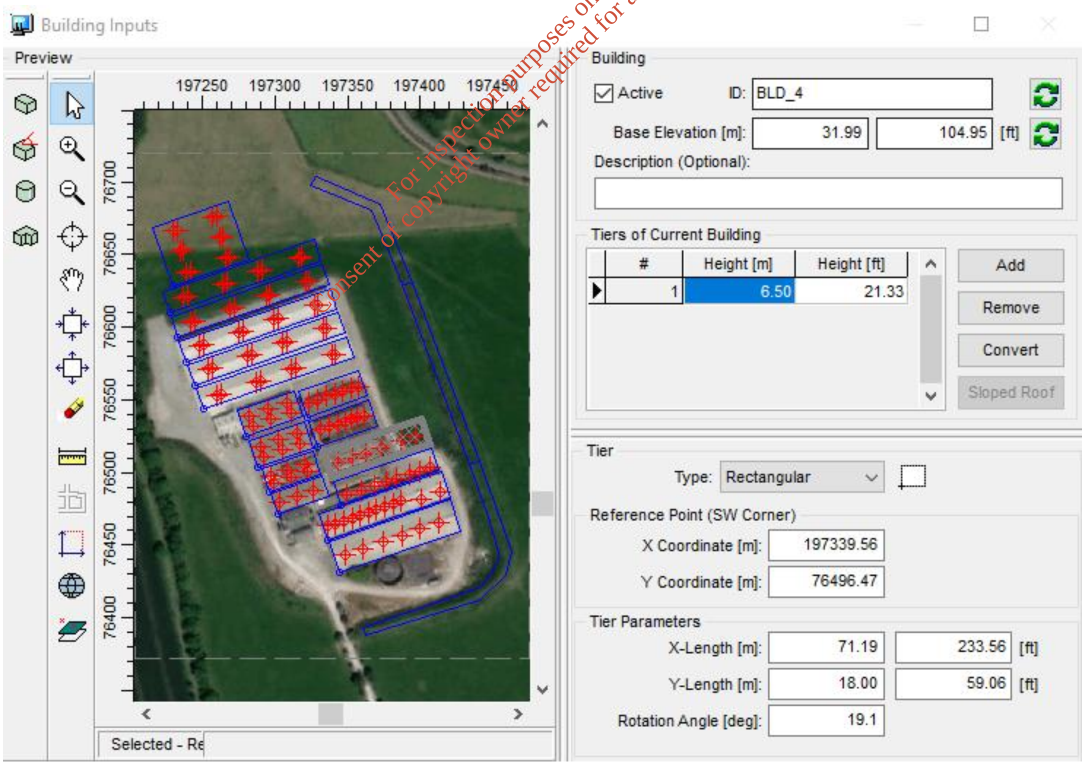
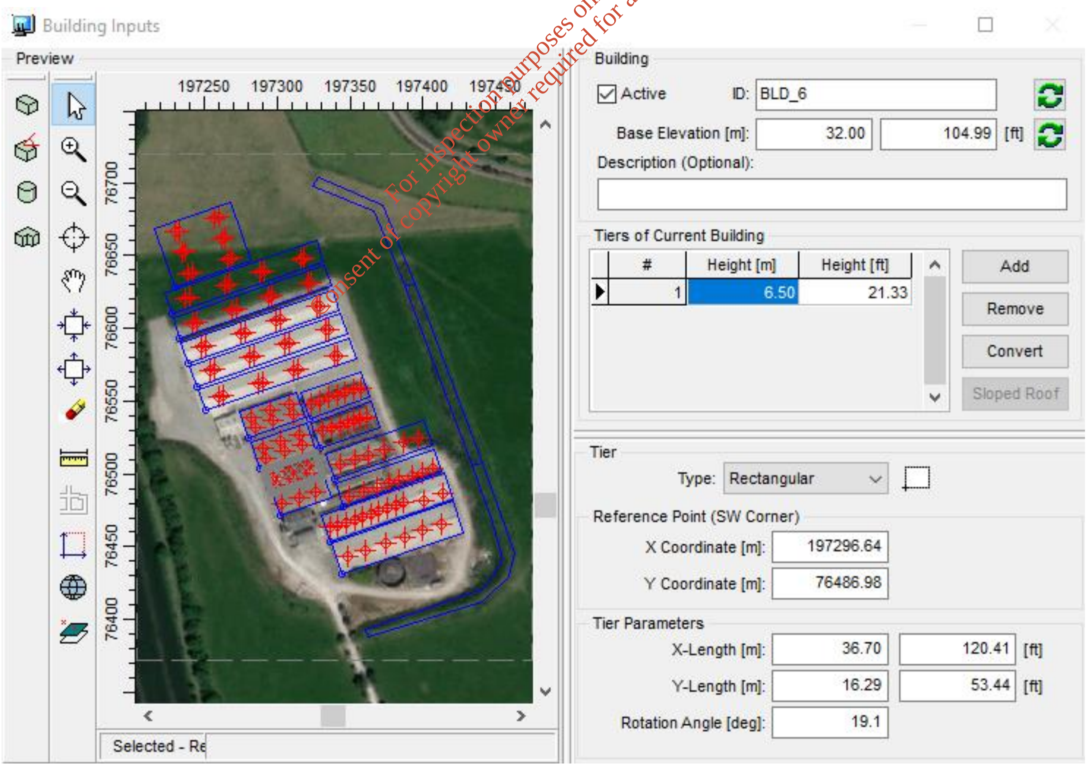
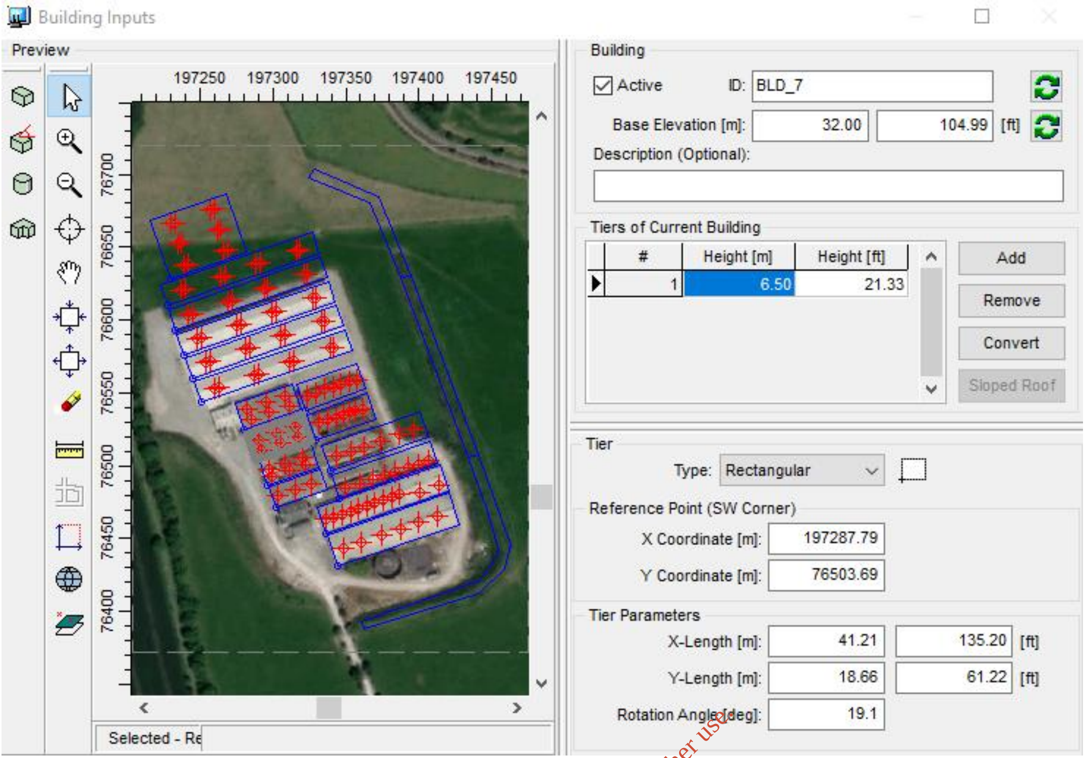
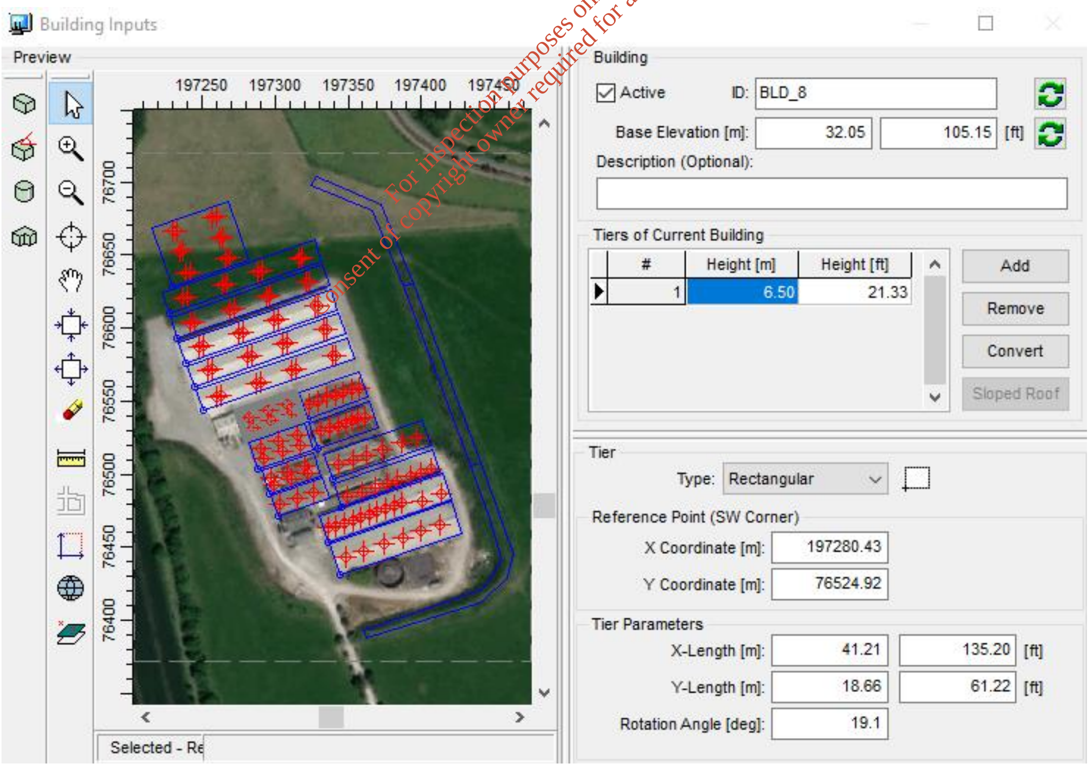
Building
Active ID: BLD_3
Base Elevation [m]: 31.27 102.59 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197345.81
Y Coordinate [m]: 76478.04
Tier Parameters
X-Length [m]: 71.19 233.56 [ft]
Y-Length [m]: 16.27 53.38 [ft]
Rotation Angle [deg]: 19.1

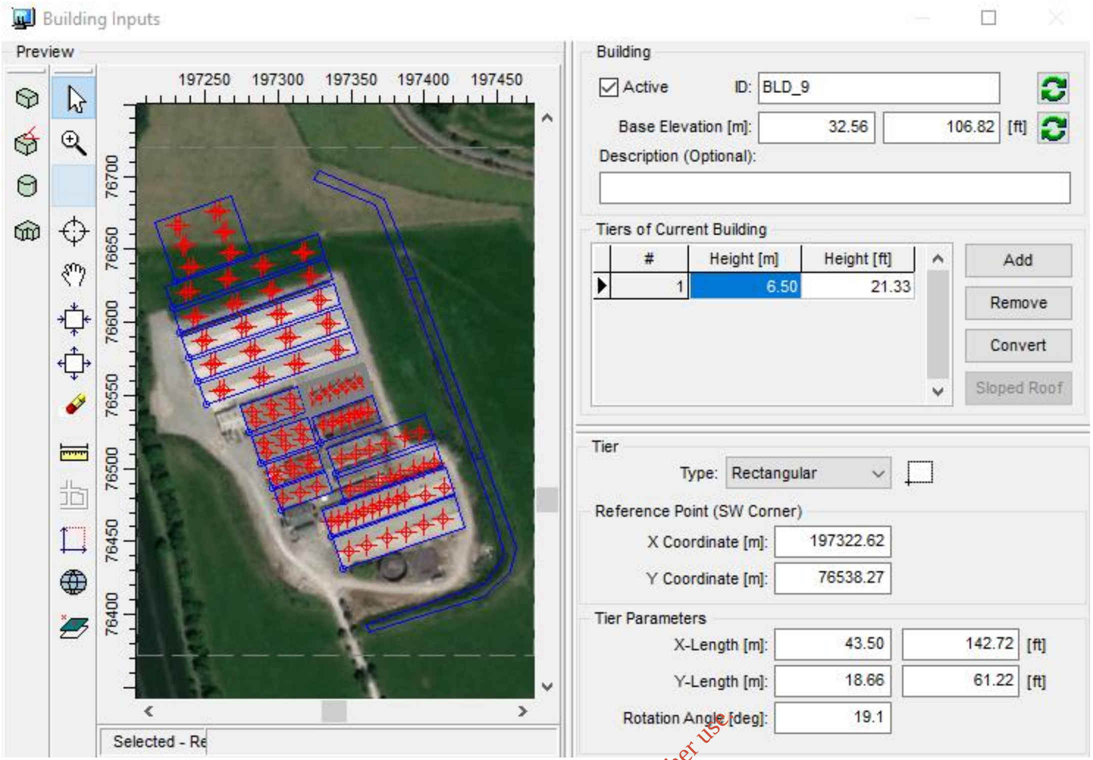

Building Inputs
Preview
197250 197300 197350 197400 197450
76700 76650 76600 76550 76500 76450 76400
Selected - Re
Building
Active ID: BLD_4
Base Elevation [m]: 31.99 104.95 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
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

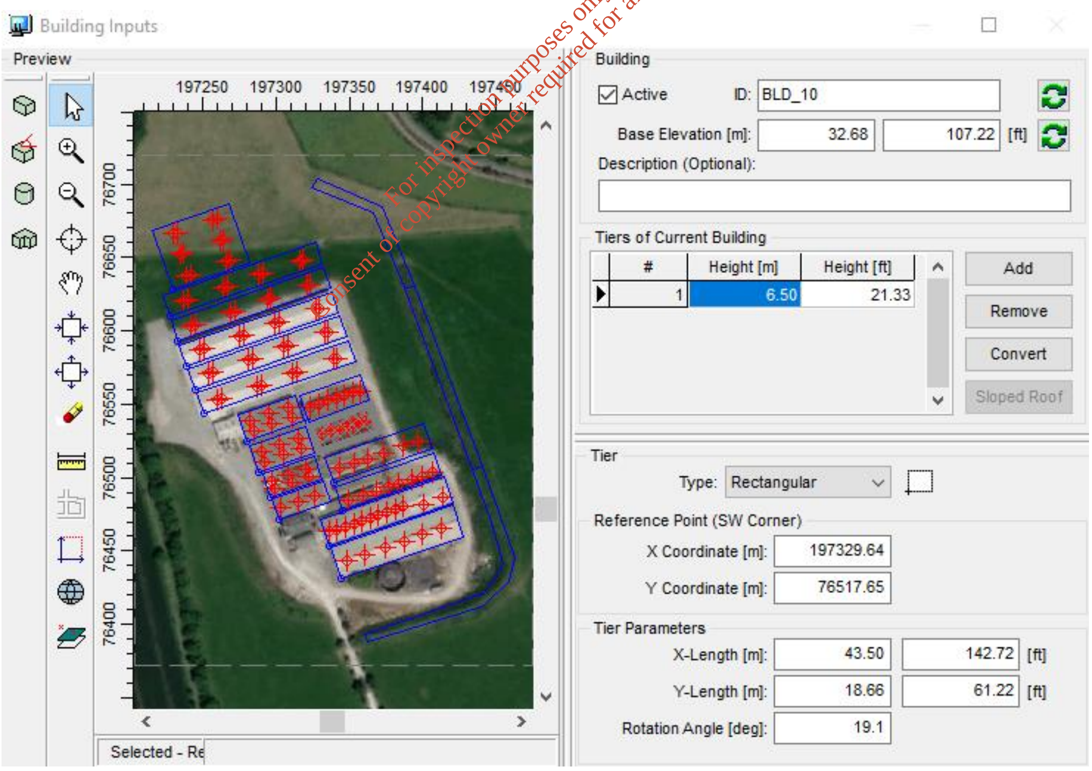

Building Inputs
Preview
197250
197300
197350
197400
197450
76700
76650
76600
76550
76500
76450
76400
Selected - Re
X: 197417.26 [m]
Y: 76617.68 [m]
Building
Active
ID:
BLD_5
Base Elevation [m]:
31.96
104.86
[ft]
Description (Optional):
Tiers of Current Building
#
Height [m]
Height [ft]
1
6.50
21.33
Add
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

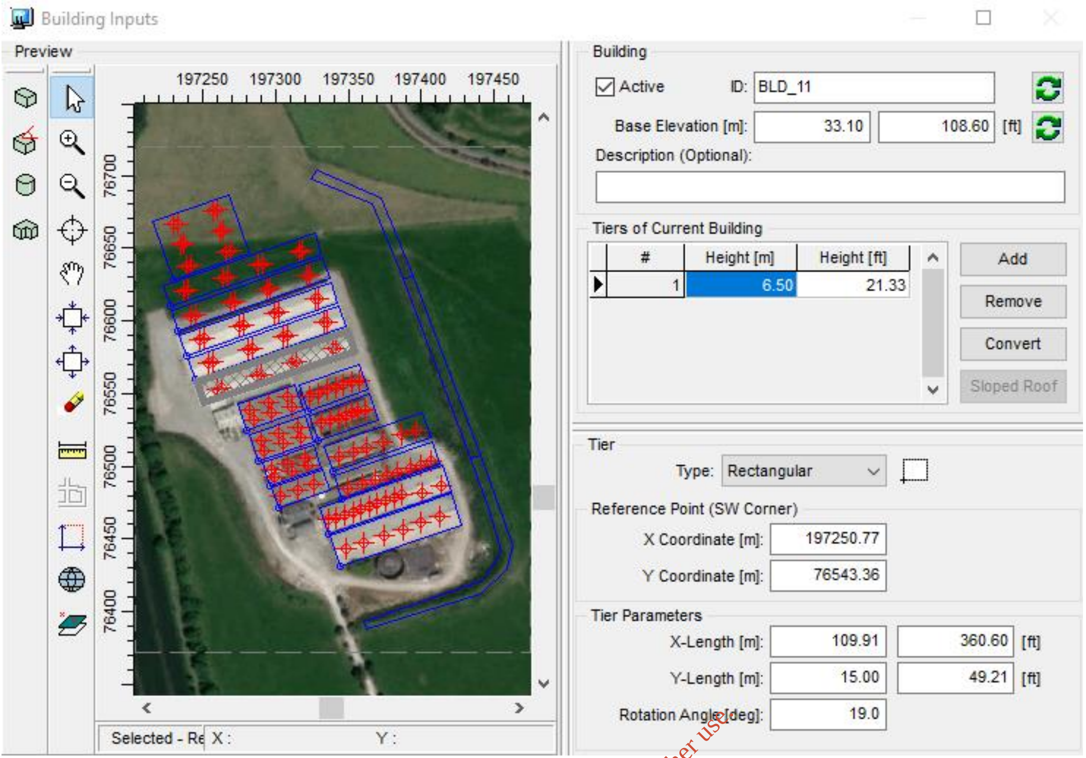

Building Inputs
Preview
197250
197300
197350
197400
197450
76700
76650
76600
76550
76500
76450
76400
Selected - Re
Building
Active
ID:
BLD_6
Base Elevation [m]:
32.00
104.99
[ft]
Description (Optional):
Tiers of Current Building
#
Height [m]
Height [ft]
1
6.50
21.33
Add
Remove
Convert
Sloped Roof
Tier
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

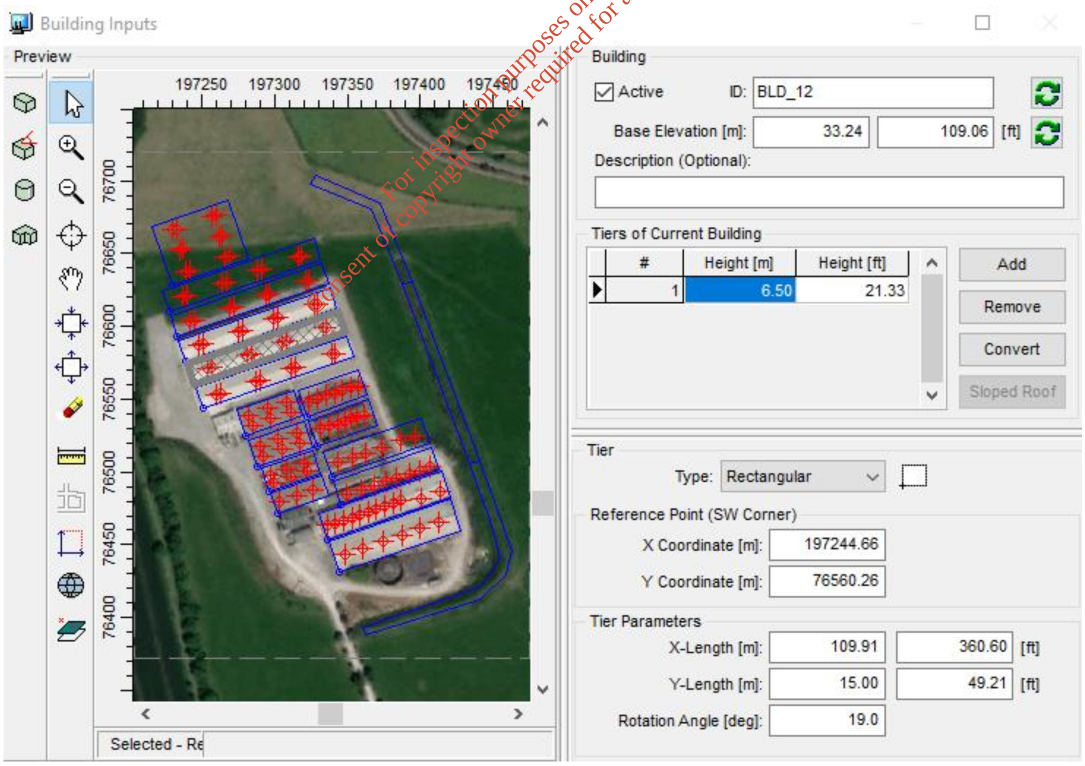

Building Inputs
Preview
197250
197300
197350
197400
197450
76700
76650
76600
76550
76500
76450
76400
Selected - Re
Building
Active
ID: BLD_7
Base Elevation [m]: 32.00 104.99 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
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

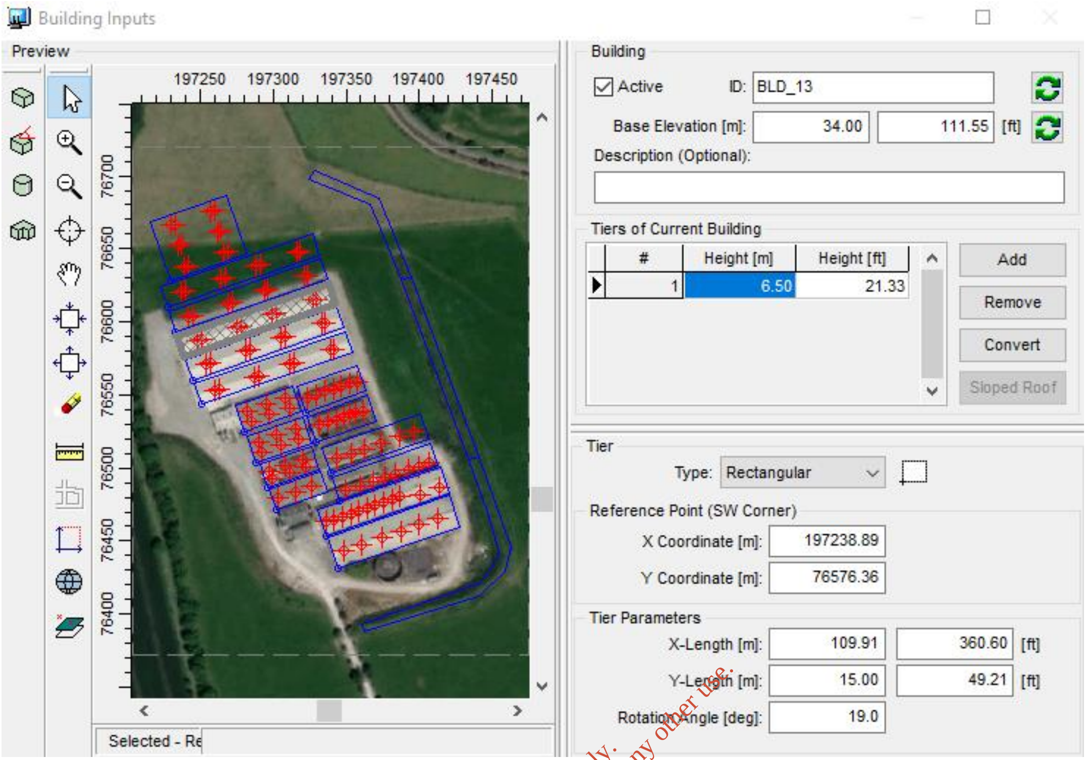

Building Inputs
Preview
197250
197300
197350
197400
197450
76700
76650
76600
76550
76500
76450
76400
Selected - Re
Building
Active
ID: BLD_8
Base Elevation [m]: 32.05 105.15 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
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

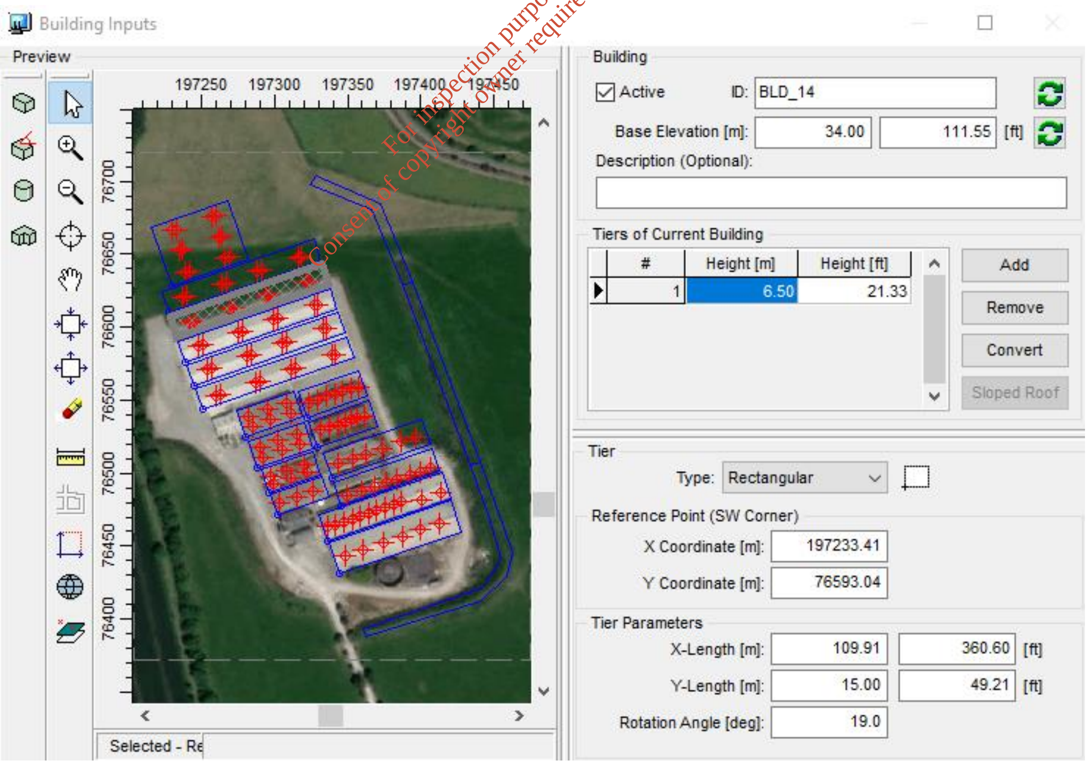

Building Inputs
Preview
197250 197300 197350 197400 197450
76700 76650 76600 76550 76500 76450 76400
Selected - Re
Building
Active
ID: BLD_9
Base Elevation [m]: 32.56 106.82 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197322.62
Y Coordinate [m]: 76538.27
Tier Parameters
X-Length [m]: 43.50 142.72 [ft]
Y-Length [m]: 18.66 61.22 [ft]
Rotation Angle [deg]: 19.1


Building Inputs
Preview
197250 197300 197350 197400 197450
76700 76650 76600 76550 76500 76450 76400
Selected - Re
Building
Active
ID: BLD_10
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]: 43.50 142.72 [ft]
Y-Length [m]: 18.66 61.22 [ft]
Rotation Angle [deg]: 19.1


Building Inputs
Preview
197250 197300 197350 197400 197450
76700 76650 76600 76550 76500 76450 76400
Selected - Re X : Y :
Building
Active ID: BLD_11
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]: 109.91 360.60 [ft]
Y-Length [m]: 15.00 49.21 [ft]
Rotation Angle [deg]: 19.0


Building Inputs
Preview
197250 197300 197350 197400 197450
76700 76650 76600 76550 76500 76450 76400
Selected - Re
Building
Active ID: BLD_12
Base Elevation [m]: 33.24 109.06 [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]: 197244.66
Y Coordinate [m]: 76560.26
Tier Parameters
X-Length [m]: 109.91 360.60 [ft]
Y-Length [m]: 15.00 49.21 [ft]
Rotation Angle [deg]: 19.0


Building Inputs
Preview
197250 197300 197350 197400 197450
76700 76650 76600 76550 76500 76450 76400
Selected - Re
Building
Active
ID: BLD_13
Base Elevation [m]: 34.00 111.55 [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]: 197238.89
Y Coordinate [m]: 76576.36
Tier Parameters
X-Length [m]: 109.91 360.60 [ft]
Y-Length [m]: 15.00 49.21 [ft]
Rotation Angle [deg]: 19.0


Building Inputs
Preview
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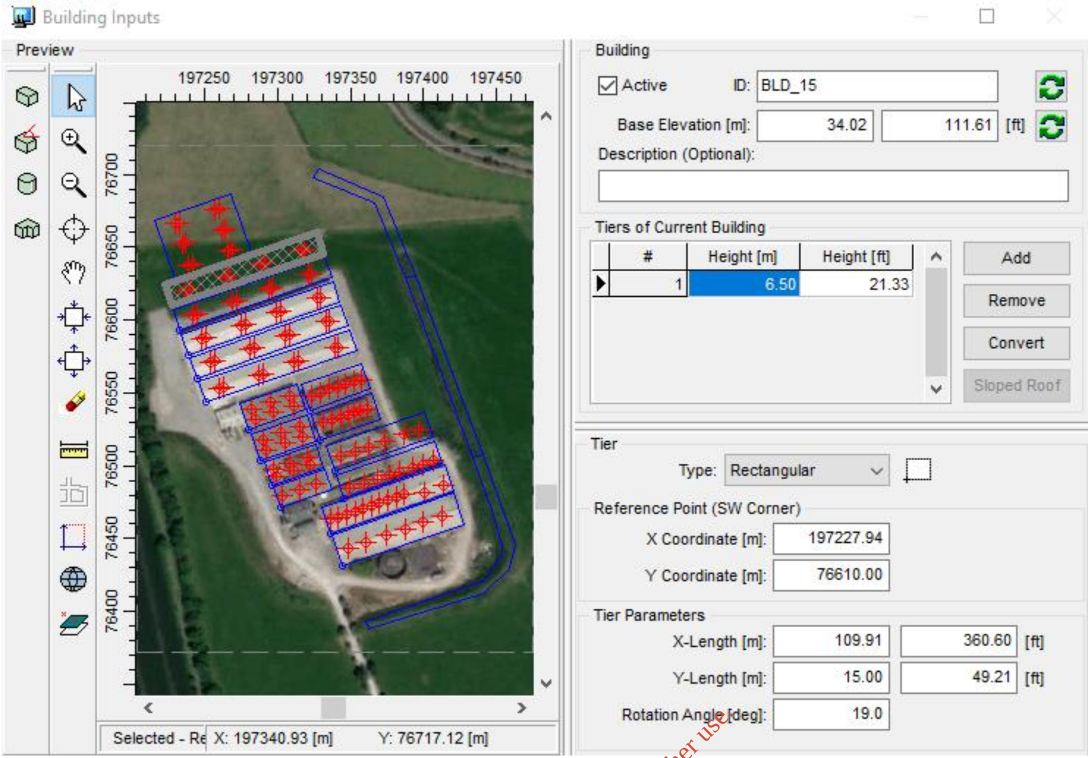
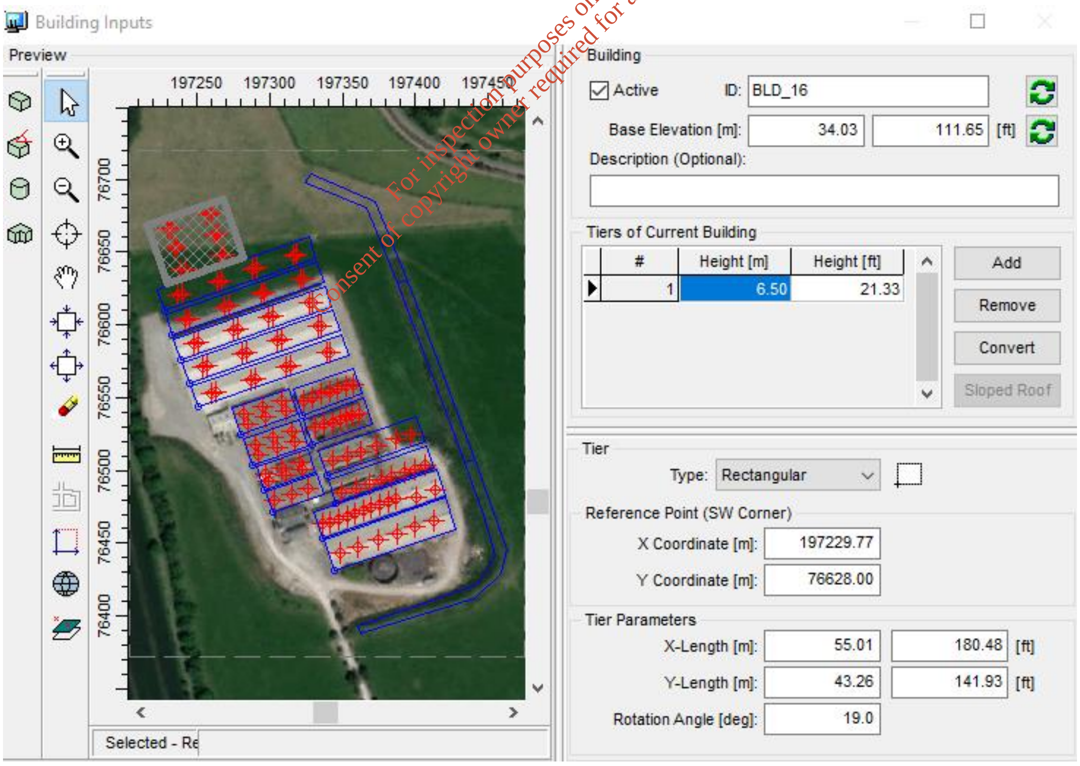
76700 76650 76600 76550 76500 76450 76400
Selected - Re
Building
Active
ID: BLD_14
Base Elevation [m]: 34.00 111.55 [ft]
Description (Optional):
Tiers of Current Building
Height [m] Height [ft]
1 6.50 21.33
Add
Remove
Convert
Sloped Roof
Tier
Type: Rectangular
Reference Point (SW Corner)
X Coordinate [m]: 197233.41
Y Coordinate [m]: 76593.04
Tier Parameters
X-Length [m]: 109.91 360.60 [ft]
Y-Length [m]: 15.00 49.21 [ft]
Rotation Angle [deg]: 19.0





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 4: Details of Nested Grid Receptors

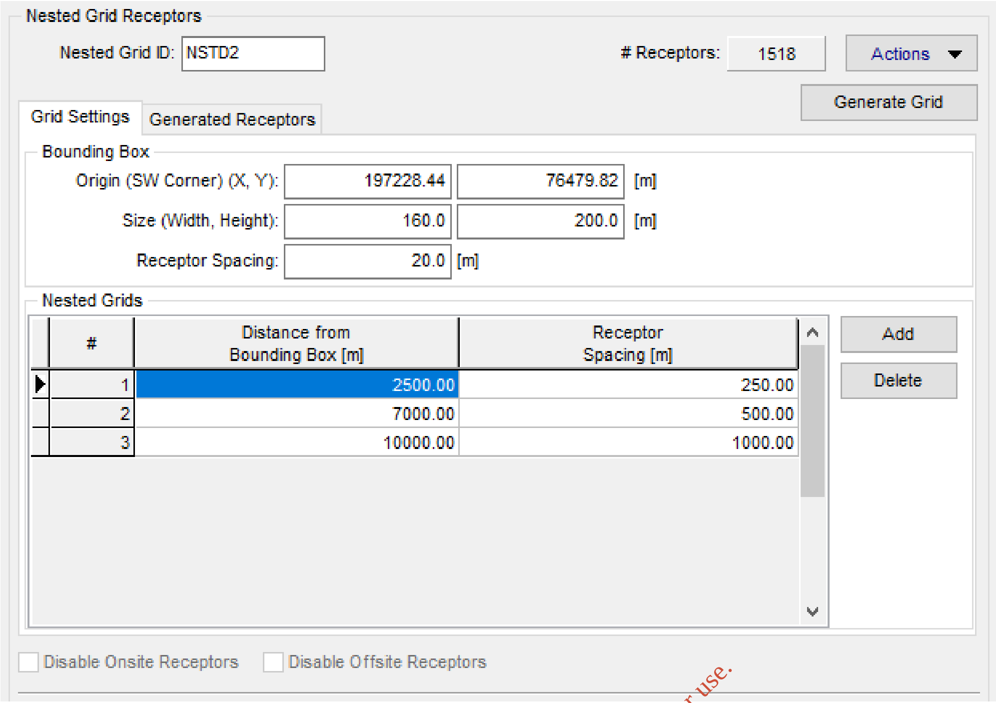
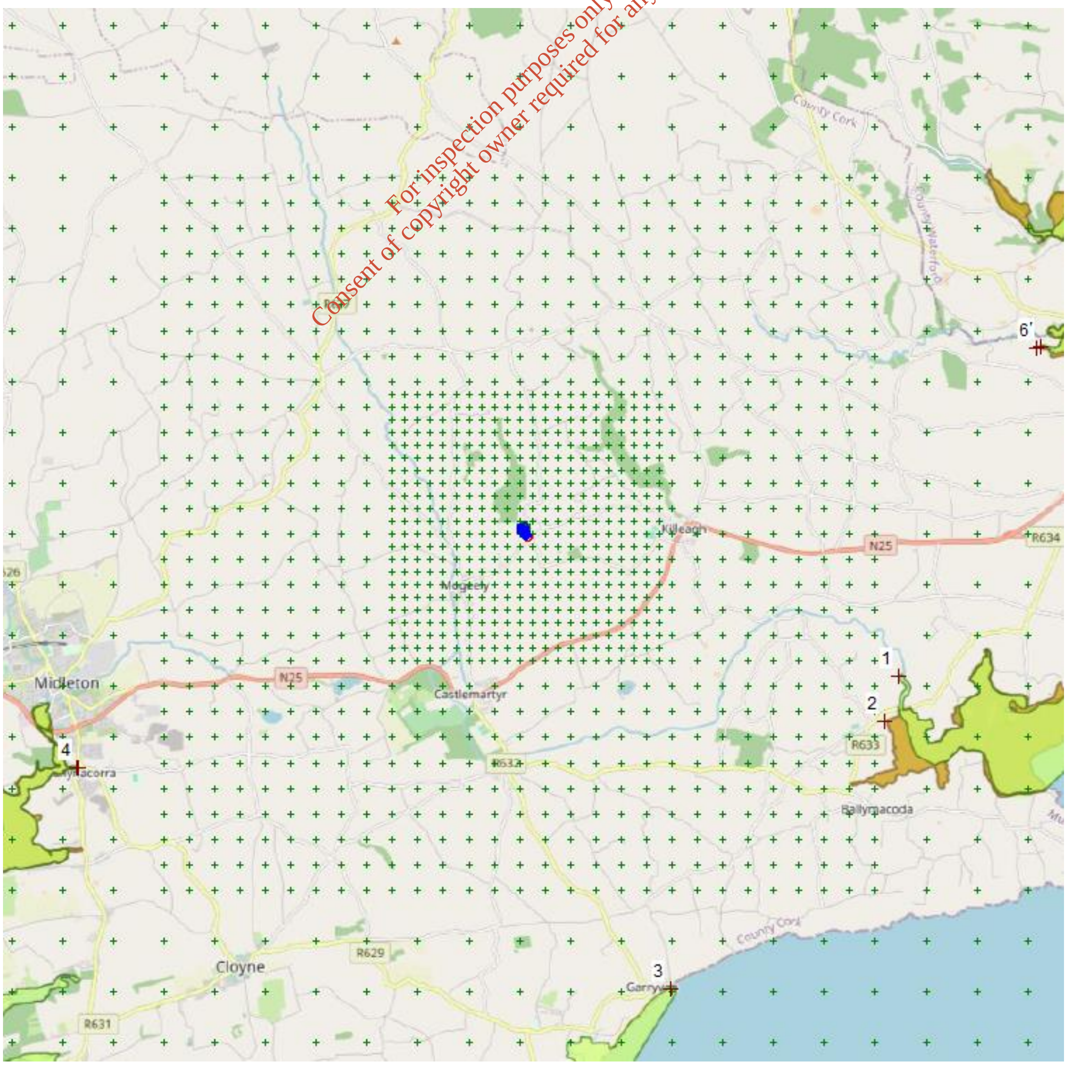
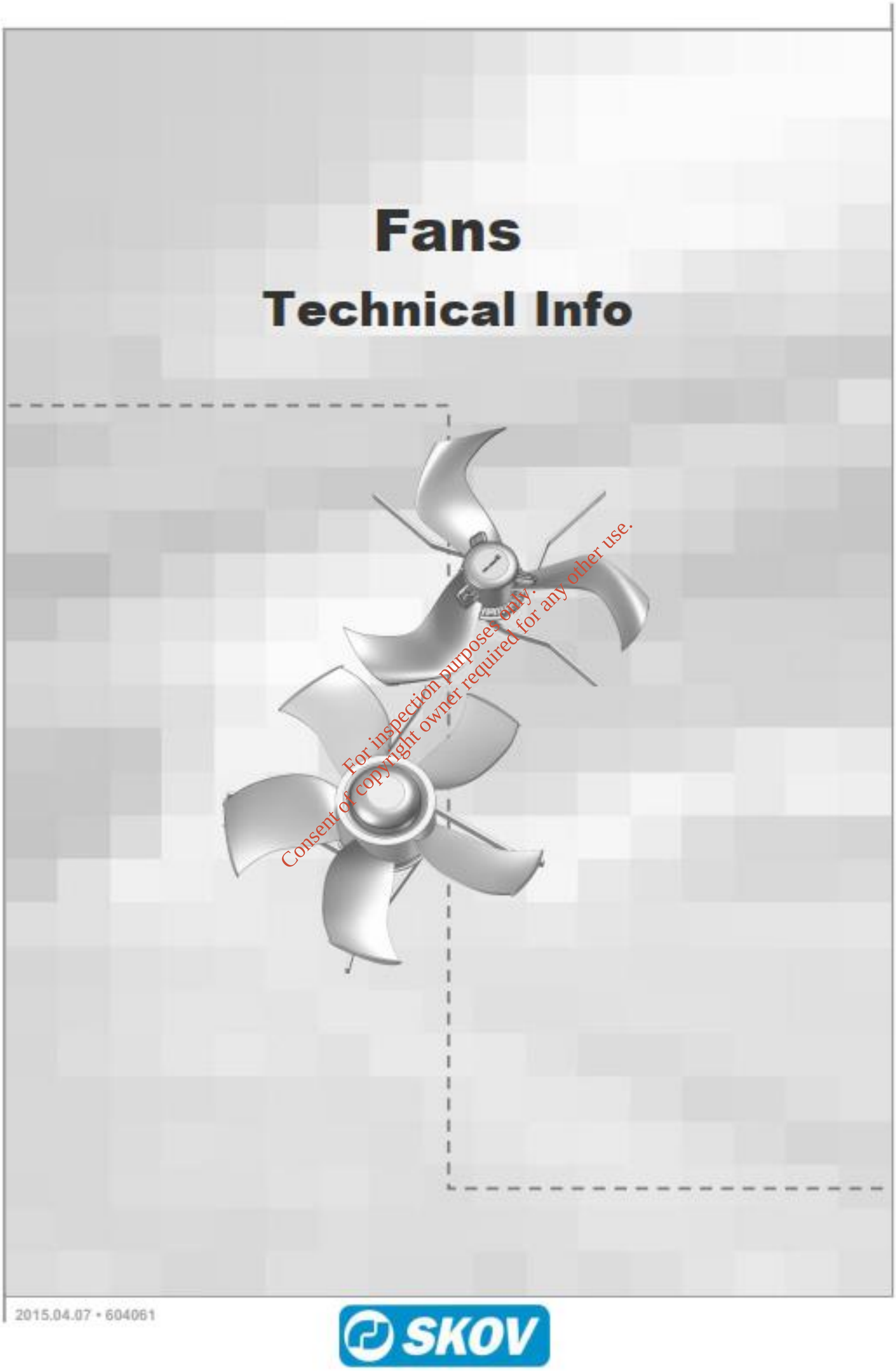


Figure 5: Graphical Representation of Nested Grid Receptors



APPENDIX C TECHNICAL SPECIFICATION



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

Code no.	Description*
60-47-7902	Fan FF063-6DT 3Ph 50/60Hz 230/400V 2,2/1,25A 0,54kW 12900m³/h Rohreinbau f/CL600 ErP2015

*Description adapted to frequency

Valid for the following chimneys
Exhaust air chimney CL 600 gray/brown

Please note:
Picture may deviate from original product

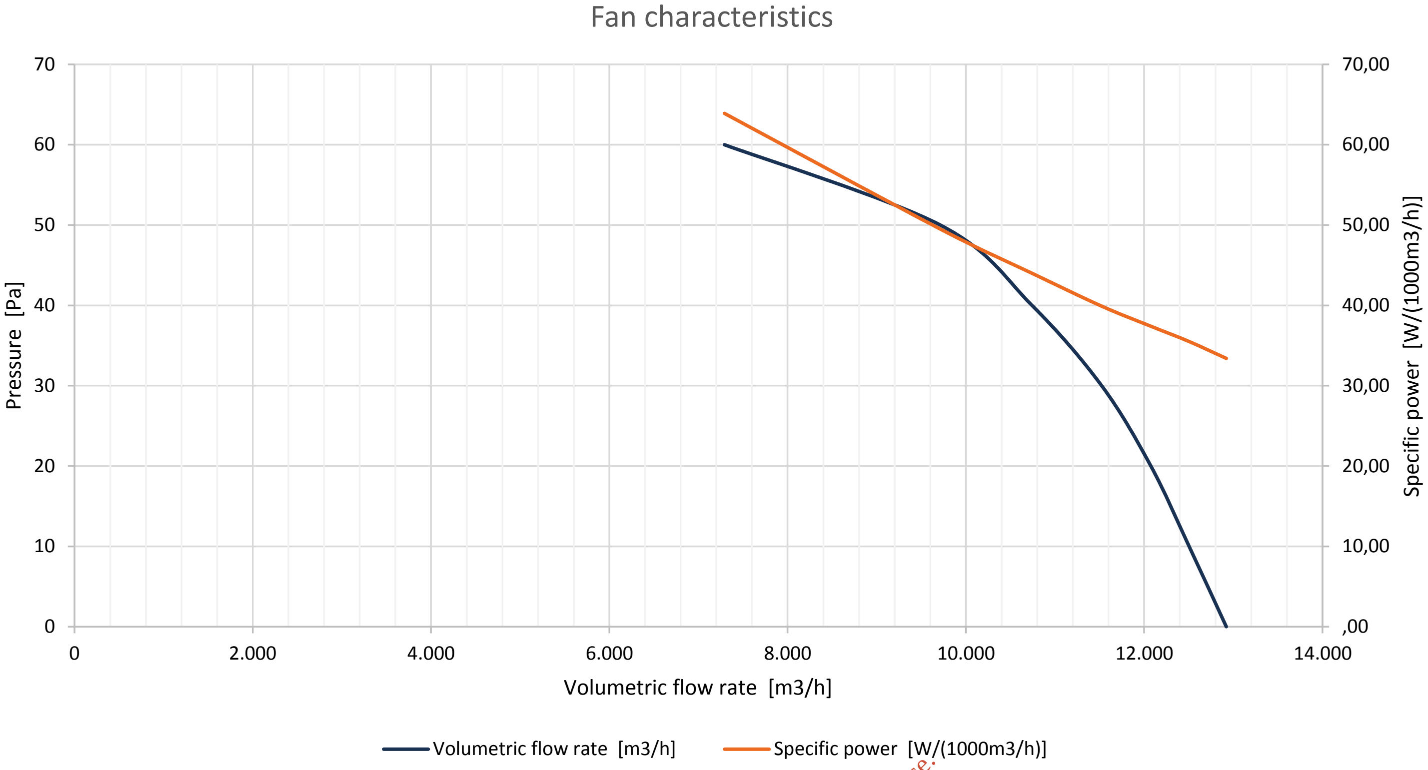
Technical data	
Phase:	3
Frequency[1)]:	50/60Hz
Nominal voltage (Y/D):	230/400 V
Nominal current (Y/D):	2,2/1,25 A
Nominal capacity:	0,54 kW
Speed:	930 rpm
Min. ambient temperature:	-40°C
Max. ambient temperature:	+70°C
Acoustic power level:	71 dB(A)
Sound pressure level[2)]:	46 dB(A)
Protection class:	IP54
Certificates:	CE, ErP2015
Controllable by:	Frequency converter (w/ all-pole sine filter) / transformer / triac

1) electrical values refer to 50Hz
2) measured at a distance of 7m

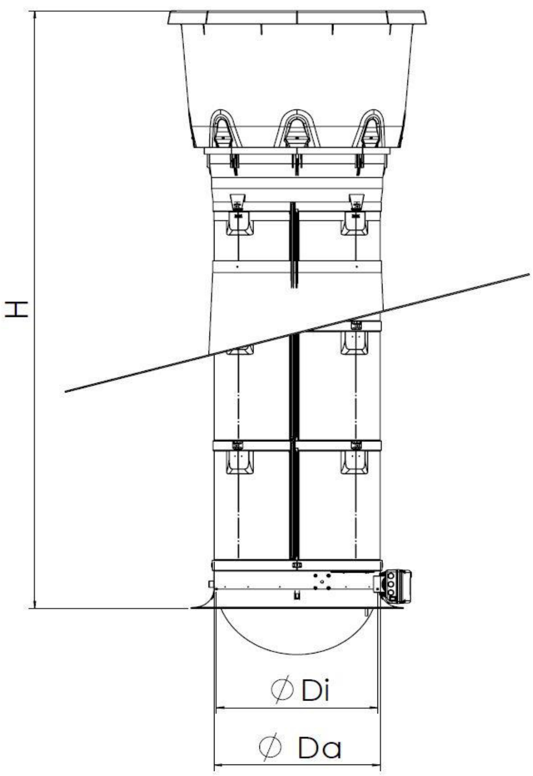
Pressure [Pa]	Volumetric flow rate [m^3/h]	Specific power [$W/(1000m^3/h)$]	Velocity[3)] [m/s]
0	12.921	33,4	10,8
10	12.504	35,5	10,5
20	12.075	37,4	10,1
30	11.523	39,9	9,6
40	10.741	44,0	9,0
50	9.713	49,5	8,1
60	7.291	63,9	6,1

3) at tube outlet

Fan characteristics



Dimensions:



	CL600: [mm]
D_i	650
D_a	666
H	Height varies

Schematic

Setpoints for controlled fans

Up to 20 Pa

Setpoint no.	Fan [%] FC / Triac	Capacity [%] FC / Triac	Flap [%] FC / Triac
0	0 / 0	0 / 0	0 / 0
1	59 / 57	15 / 14	42 / 42
2	59 / 57	31 / 29	60 / 60
3	59 / 57	43 / 43	73 / 73
4	59 / 57	57 / 57	100 / 100
5	71 / 70	71 / 71	100 / 100
6	86 / 85	85 / 85	100 / 100
7	100 / 100	100 / 100	100 / 100

Up to 40 Pa

Setpoint no.	Fan [%] FC / Triac	Capacity [%] FC / Triac	Flap [%] FC / Triac
0	0 / 0	0 / 0	0 / 0
1	71 / 70	14 / 14	37 / 38
2	71 / 70	29 / 29	53 / 54
3	71 / 70	43 / 44	65 / 67
4	71 / 70	58 / 57	77 / 77
5	71 / 70	71 / 71	100 / 100
6	86 / 85	85 / 85	100 / 100
7	100 / 100	100 / 100	100 / 100

Subject to technical changes and further development.

60-47-7902
Edition: 12/2016-GB

Code no.	Description*
60-47-8973	Fan EC-Blue FF063-ZIT 1Ph 50/60Hz 200-277V 4,6-3,3A 0,92kW 15600m³/h Rohreinbau f/CL600 ErP2015

*Description adapted to frequency

Valid for the following chimneys
Exhaust air chimney CL 600 gray/brown

Please note:
Picture may deviate from original product

Technical data	
Phase:	1
Frequency[1)]:	50/60Hz
Nominal voltage:	200-277 V
Nominal current:	4,6-3,3 A
Nominal capacity:	0,92 kW
Speed:	1200 rpm
Min. ambient temperature:	-35°C
Max. ambient temperature:	+55°C
Acoustic power level:	75 dB(A)
Sound pressure level[2)]:	50 dB(A)
Protection class:	IP55
Certificates:	CE, UL, ErP2015
Controllable by:	0-10V

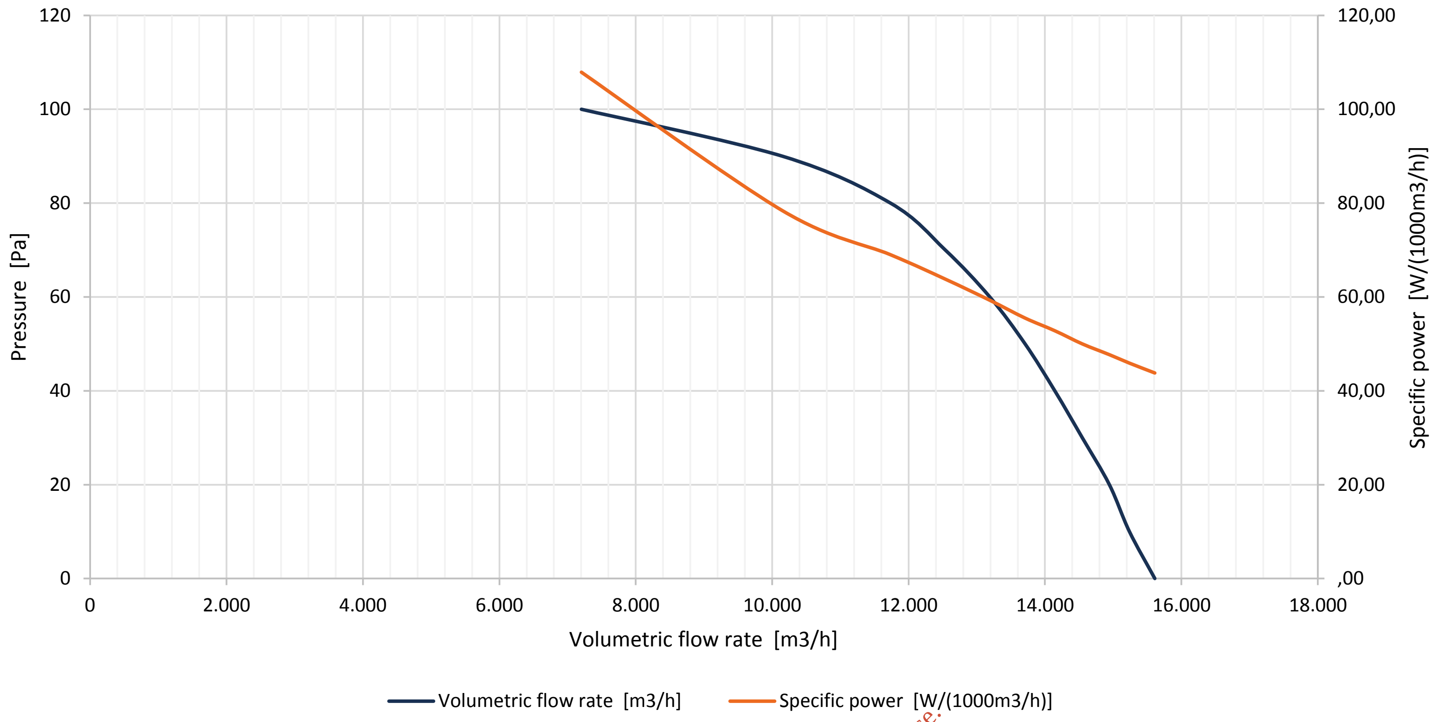
1) electrical values refer to 50Hz

2) measured at a distance of 7m

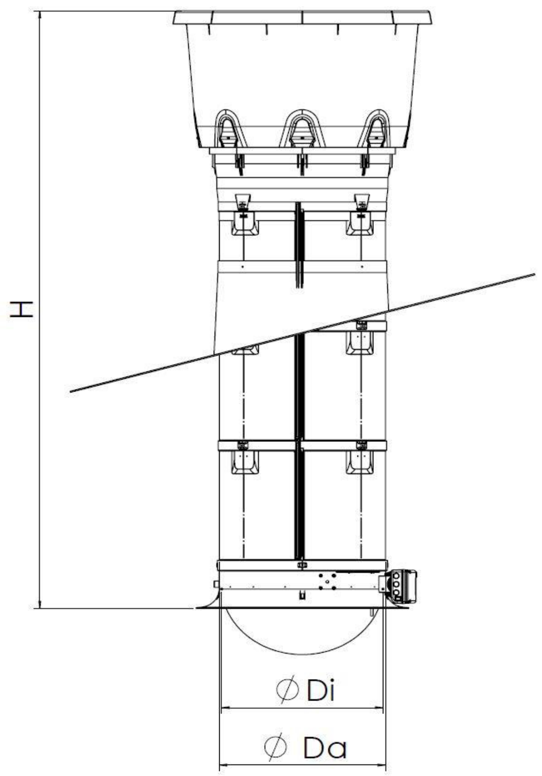
Pressure [Pa]	Volumetric flow rate [m^3/h]	Specific power [W/(1000m^3/h)]	Velocity[3)] [m/s]
0	15.610	43,8	13,1
10	15.238	45,9	12,8
20	14.944	47,7	12,5
30	14.547	50,0	12,2
40	14.144	52,8	11,8
50	13.708	55,5	11,5
60	13.191	59,3	11,0
70	12.539	63,8	10,5
80	11.735	69,0	9,8
90	10.150	78,4	8,5
100	7.203	107,9	6,0

3) at tube outlet

Fan characteristics



Dimensions:



	CL600: [mm]
D_i	650
D_a	666
H	Height varies

Schematic

Setpoints for controlled fans

Up to 20 Pa

Setpoint no.	Fan [%] EC	Capacity [%] EC	Flap [%] EC
0	0	0	0
1	57	13	39
2	57	29	57
3	57	43	72
4	57	57	100
5	71	71	100
6	85	85	100
7	100	100	100

Up to 40 Pa

Setpoint no.	Fan [%] EC	Capacity [%] EC	Flap [%] EC
0	0	0	0
1	71	13	35
2	71	29	51
3	71	43	64
4	71	57	74
5	71	71	100
6	85	85	100
7	100	100	100

Code no.	Description*
60-47-8991	Fan EC-Blue FF091-ZIT 1Ph 50/60Hz 200-277V 5-3,6A 0,96kW 26000m³/h Rohreinbau ErP2015

*Description adapted to frequency

Valid for the following chimneys
Exhaust air chimney BD 920/50-AF gray/brown
Exhaust air chimney BD 920/30-AF gray/brown
Exhaust air chimney BD 920/30-VC gray/brown
Exhaust air chimney CL 920-30-2 gray/black

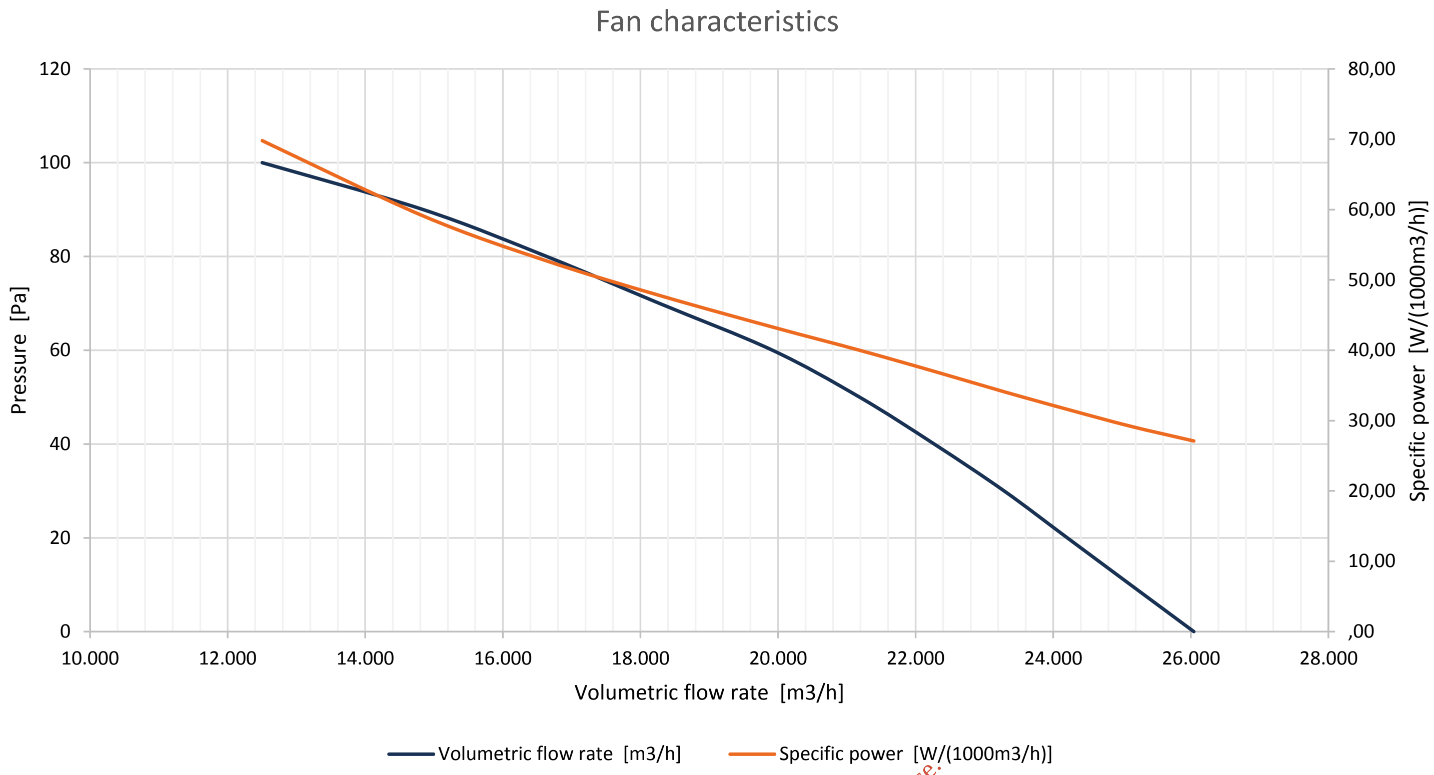
Please note:
Picture may deviate from original product

Technical data	
Phase:	1
Frequency[1)]:	50/60Hz
Nominal voltage:	200-277 V
Nominal current:	5-3,6 A
Nominal capacity:	0,96 kW
Speed:	950 rpm
Min. ambient temperature:	-35°C
Max. ambient temperature:	+40°C
Acoustic power level:	77 dB(A)
Sound pressure level[2)]:	52 dB(A)
Protection class:	IP55
Certificates:	CE, UL, ErP2015
Controllable by:	0-10V

1) electrical values refer to 50Hz
2) measured at a distance of 7m

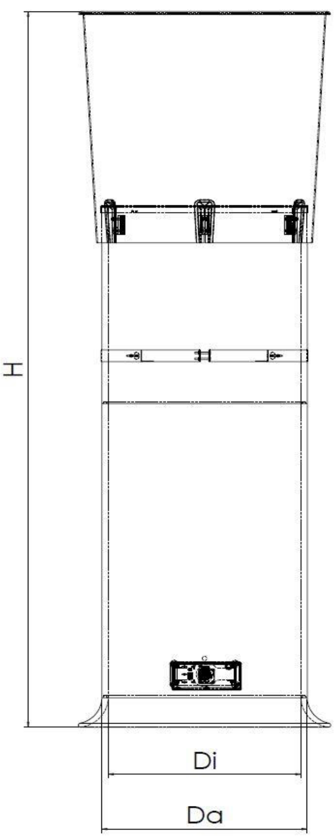
Pressure [Pa]	Volumetric flow rate [m³/h]	Specific power [W/(1000m³/h)]	Velocity[3)] [m/s]
0	26.044	27,1	10,9
10	25.123	29,2	10,5
20	24.204	31,6	10,1
30	23.286	34,1	9,7
40	22.270	37,0	9,3
50	21.185	40,0	8,9
60	19.920	43,3	8,3
70	18.275	47,8	7,6
80	16.637	52,7	7,0
90	14.841	59,1	6,2
100	12.502	69,8	5,2

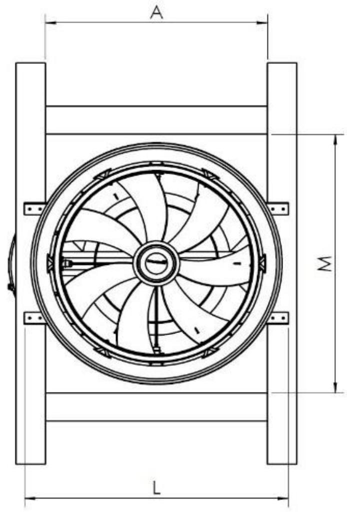
3) at tube outlet



Dimensions:

	Air duct: [mm]	Agroflex / Varioclip: [mm]	CL920-2: [mm]
T	50	30	33
D_i	920	920	920
D_a	1024	984	1004
L	1230	1190	1204
A_{min}	1065	1025	1030
A_{max}	1090	1050	1064
M_{min}	1330	1290	1304
H	Height varies		





Schematic

Subject to technical changes and further development.
60-47-8991
Edition: 12/2016-GB

Setpoints for controlled fans

Up to 20 Pa

Setpoint no.	Fan [%] EC	Capacity [%] EC	Flap [%] EC
0	0	0	0
1	57	13	44
2	57	28	61
3	57	43	77
4	57	57	100
5	71	71	100
6	85	85	100
7	100	100	100

Up to 40 Pa

Setpoint no.	Fan [%] EC	Capacity [%] EC	Flap [%] EC
0	0	0	0
1	71	13	41
2	71	29	57
3	71	43	68
4	71	57	81
5	71	71	100
6	85	85	100
7	100	100	100

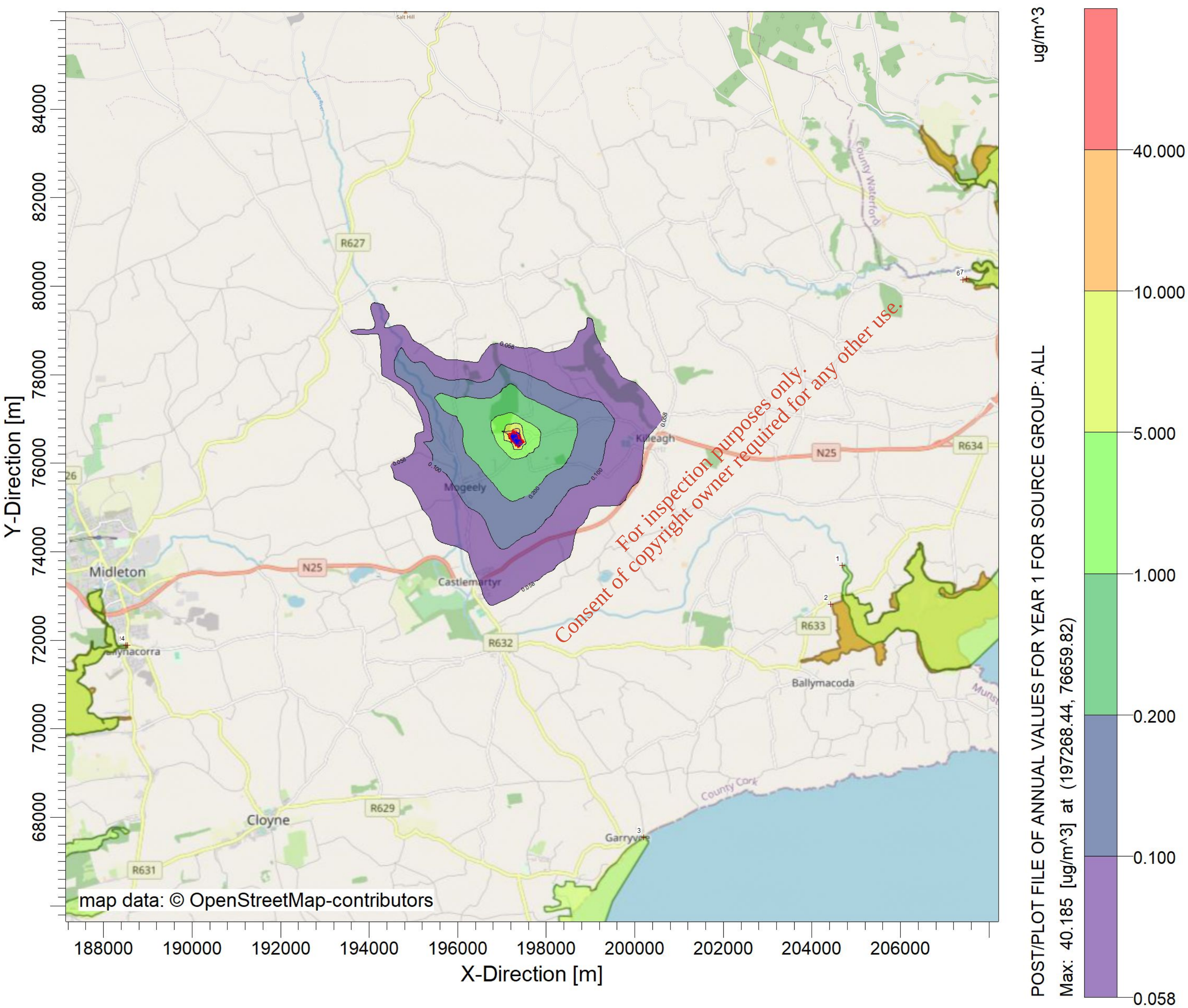
APPENDIX D MODELLING RESULTS

The Figure below details the predicted impact of the sheds based on Section 3.2 of this report.

It should be noted that the outermost contour (0.058µg /m^3) corresponds to a nitrogen deposition of 0.3kg.N/ha/yr, which is considered deminimus for the purposes of a Nitrogen assessment.

PROJECT TITLE:

Eoin O'Brien Pigs
Annual Average Ground Level Ammonia Concentration (ug/m3) (2020)



COMMENTS:

SOURCES:
121

RECEPTORS:
1525

OUTPUT TYPE:
Concentration

MAX:
40.185 ug/m^3

MODELER:
Christy Carr

DATE:
29/03/2021

SCALE: 1:139,999

0 4 km

IRWIN CARR CONSULTANTS

PROJECT NO.:
2020191

AERMOD View - Lakes Environmental Software