Curtin Agricultural Consultants Ltd

Agricultural & Environmental Consultants

12 The Paddocks
Kells Road
Kilkenny
R95 VX4K

Telephone	*(056) 7752026*
Mobile	*(087) 2588798*
E mail	*curtinagri@gmail.com*
Website	*curtinagriculturalconsultants.com*

Date : 20/11/2023 **Our ref. :**

Your ref. :

Linda Cahill

Environmental Licensing Programme
Office of Environmental Sustainability

Reg. No: P0915-02

Regulation 10(2)(b)(ii) of the EPA (Industrial Emissions) (Licensing) Regulations 2013, in respect of a licence review from Ballyfaskin Enterprises Ltd for an installation located at Ballyfauskeen, Ballylanders, County Limerick.

In response to your correspondence dated 08/09/2023;

RESPONSE TO PART 1.a)

Please find attached written confirmation that Curtin Agricultural Consultants requested Limerick County Council to confirm that an EIAR was not required for planning application 2014/276 - but a response has not been received at this time. If such a response is received it will be forwarded to the EPA.

RESPONSE TO PART 1.b)

i. The status of the proposed development work was that the current livestock numbers are;

Farrowing / Sucking sows	500
Dry sows	100
Maiden Gilts	150
Boars	10
Weaners	3450
Production pigs	3750

The proposed electrical sub-station has not been built.

ii. The development works (electrical sub-station) has not been completed. The current pig numbers are as per item 1.b. i above;

iii. The proposed electrical sub-station will be completed before end of November 2025.

RESPONSE TO PART 2.a)

The pig current numbers are provided above in response to item 1.b i

RESPONSE TO PART 2.b)

The emissions figures, calculations and emission estimations are as per attachment 4-6-2 and 4-8-1 of the License Review documentation – with an amendment for the slurry figures as per response 4 a) below and corrected Attachment 4-8-1 which is attached to this response. These are further summarised in Table 1.7 (Environmental and operational changes resulting from the proposed pig farm development) of Volume 2 of the 2020 EIAR as follows;

Table 1.7: Environmental and operational changes resulting from the proposed pig farm development.

Item	Existing	Proposed	Comment
1. Pig manure production (m^3)*	15,681	15,805	Addressed in Chapters 1, 3, 4, 5 & 9
2. Pig manure N, P (Kgs / year)*	65,860 12,545	66,381 12,644	Addressed in Chapter 5
3. Feed (tons) **	5,960	6,760	Addressed in Chapters 1 & 3
4. Water used (m^3) **	15,500	17,600	Addressed in Chapters 1, 3, 6 & 9
5. Storm water produced (m^3)***	32,600	32,600	Addressed in Chapters 1 & 6
6. Traffic to pig farm (per day)	14	16	Addressed in Chapters 1 & 3
7. Noise	Not significant	Not significant	Addressed in Chapters 1, 3 & 4
8. Municipal Waste (tons)	1.0	1.0	Addressed in Chapters 1, 3 & 8
9. Sharps waste (kgs)$^{+}$	0.004	0.01	Addressed in Chapters 1, 3 & 8
10. Carcass waste (tons)$^{+}$	113	137	Addressed in Chapters 1, 3 & 8
11. Floor area (m^2)	14,238	14,260	Addressed in Chapter 1
12. Labour employed **	5	6	Addressed in Chapters 1 & 3
13. Power / electricity (MWtHr)$^{+}$	470	590	Addressed in Chapters 1, 3, 8 & 9
14. NH_3 production (tons)$^{++}$ (with mitigation)	18.5	19.5 (16.4)	Addressed in Chapters 3, 7 & 8
15. CH_4 production (tons)$^{++}$ (with mitigation)	106.5	125.3 (125.3)	Addressed in Chapters 3, 7 & 8
16. N_2O production (tons)$^{++}$ (with mitigation)	0.108	0.116 (0.116)	Addressed in Chapters 3, 7 & 8
17. CO_2 equivalent (tons)$^{++}$ (with mitigation)	2,645	3,104	Addressed in Chapter 8
18. Odour units (with mitigation)	146,170	143,432 (119,196)	Addressed in Chapter 7

* Calculated based on Tables 1 and 7 of Si 605 of 2017 (as amended in SI 65 of 2018 and SI 40 of 2020)

** Estimated based on Teagasc data

*** Based on hard standing concrete yards and roof area of 22,400m^2 and 1,456 mm of rain.

+ Based on AER data available on EPA.ie

++ EPA IPPC AER/PRTR fugitive emissions tool for intensive agriculture

RESPONSE TO PART 3.a)

Aerial map @ 1:5,000 @ A3 is attached showing site location and surface water features relevant to the site.

RESPONSE TO PART 3.b)

Site map @ 1:5,000 @ A3 is attached showing the storm water discharge points. This is the same as the original site map in Appendix 3-2 Figure 1(a).
National Grid Reference of storm water monitoring points;

- STW1 - 578902, 623508
- STW2 - 579098, 623481

RESPONSE TO PART 4.a)

Slurry production – 15,805m^3 - for the predicted pig numbers is calculated using figures in Table 1 of Schedule 2 of SI 605 of 2017.

- 1,000 sows and progeny to 36kgs = 1,000 @ 0.174 m^3 per week = 9,048m^3;
- 3,957 finishing unit pigs @ 0.033m^3 per week = 6,757m^3

The volume of slurry produced is 15,805m^3

- Kgs of N = 66,381
- Kgs of P = 12,644 (corrected)
- Kgs of K = 60,000

The corrected Appendix 4-8-1 is attached. The original Appendix 4-8-1 for the License Review Application states 12,545 kgs of P which is approximately 1% lower (99kgs). This is not a materially significant amount and the correct figure of 12,644 kgs of P is used in Table 1.7 and in Section 5.3.4 (Nutrient Management of Pig Manure P & N) of Volume 2 of the 2020 EIAR in the existing Study Area.

RESPONSE TO PART 4.b)

The 2022 Record 3 form is not submitted with this response, but it is available on site for inspection by EPA staff and has been submitted to The Department of Agriculture, Food and the Marine.

RESPONSE TO PART 5.a)

Pig manure is a byproduct which is used by customer farmers. Each year individual customer farmer's nutrient requirement may fluctuate or new customers may arise – it is not a fixed situation. Each year the pig manure movements are recorded on a Record 3 form which is submitted to The Department of Agriculture, Food and the Marine (DAFM). With this information DAFM can monitor the movement of pig manure to insure that it is compliance with the regulations. DAFM holds information on the customer

farmers which allows it to monitor the capacity of customer farmers. The information sought in Appendix 7.6.2 is available only from DAFM and not available to the Licensee.

The information provided in Table 7.6.2 (iii) is a summary of the information provided in Section 5.3.4 (Nutrient Management of Pig Manure P & N) of Volume 2 of the 2020 EIAR – which demonstrates that there is sufficient capacity in the study area to accommodate the pig manure where it replaces chemical P fertiliser. Figures 5.4.1 to 5.4.33 show the available lands for pig manure in 2019 and 2020 where lands are assessed as suitable according to the SI 605 of 2017 Regulations (as amended).

A revised Attachment 7.6.2 is submitted to provide the County, areas within each townland and the import capacity of each townland to demonstrate that there is adequate capacity within the study area for the proposed pig farm development.

RESPONSE TO PART 5.b)
The import capacity of the study area for the pig farm development is 55,430kgs of P

RESPONSE TO PART 5.b)
The import capacity of the study area for the pig farm development is 55,430kgs of P. The pig farm is projected to produce 12,644kgs – therefore there is sufficient capacity in the spreadlands available to the pig farm

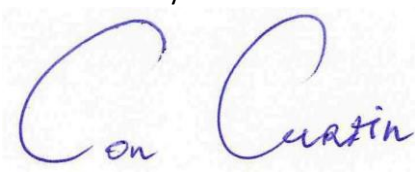
RESPONSE TO PART 6 a)
A revised odour assessment is attached which was conducted in in accordance with EPA'S Air Dispersion Modelling Guidance Note (AG4). As concluded in Section 7 of the report *The odour modelling assessment found that the predicted concentrations of odour at all sensitive receptors comply with odour criterion recommended by EPA for existing pig farms of 5.0ouE/m3 at all modelled sensitive receptor locations*

RESPONSE TO PART 6. b)
A revised odour assessment is attached which was conducted in in accordance with EPA'S Air Dispersion Modelling Guidance Note (AG4). As concluded in Section 7 of the report - *The odour modelling assessment found that the predicted concentrations of odour at all sensitive receptors comply with odour criterion recommended by EPA for existing pig farms of 5.0ouE/m3 at all modelled sensitive receptor locations*

RESPONSE TO PART 7)
Based on the attached Ammonia Assessment there are no significant cumulative effects on Natura Sites and no requirement to revise the NIS – see attached NIS letter from Ash Ecology (author of NIS).

There is no significant additional information which impinges on the Non-technical Summary – the additional odour and ammonia assessments are submitted here in support of the existing information.

Yours sincerely



_____

Con Curtin (B.Agric.Sc)

087-2588798

Curtin Agricultural Consultants Ltd

Agricultural & Environmental Consultants

12 The Paddocks
Kells Road
Kilkenny
R95 VX4K

Telephone	*(056) 7752026*
Mobile	*(087) 2588798*
E mail	*curtinagri@gmail.com*
Website	*curtinagriculturalconsultants.com*

Date : 16/10/2023 **Our ref. :**

Your ref. :

Planning & Environmental Services
Floor 1
Limerick City and County Council
Dooradoyle Road
Dooradoyle
Limerick V94 WV78

Re: Ballyfaskin Pig Enterprises Ltd, Ballyfauskeen, Ballylanders, Co. Limerick, V35KV12.

Regulation 10(2)(b)(ii) of the EPA (Industrial Emissions) (Licensing) Regulations 2013, in respect of a licence review from Ballyfaskin Enterprises Ltd for an installation located at Ballyfauskeen, Ballylanders, County Limerick.

A Chara

In correspondence dated 11/04/2022 we notified your department that an application for the review of a License had been made to the EPA. Following this we have received a request for further information from the EPA which is as follows;

1. *With regards to planning permissions granted for this site:*

Provide written confirmation from the planning authority as to whether or not an Environmental Impact Assessment was required for planning permission reference 14/276, by or under the Planning and Development Act 2000, as amended;

Can you please provide us with this confirmation at your earliest convenience.

Con Curtin (B.Agric.Sc)

Planning Reference 14/276 Ballyfaskin Enterprises Ltd, Ballyfauskeen, Ballylanders, County Limerick

Inbox ×

Con Curtin <curtinagri@gmail.com>
to customerservices

Mon, 16 Oct, 12:31

Dear Planning Department

Please find attached request, from EPA, for confirmation that an EIAR was, or was not, required for planning permission Ref 14/276

Con Curtin
Curtin Agricultural Consultants Ltd
12 The Paddocks
Kells Road
Kilkenny
056-7752026
087-2588798
curtinagriculturalconsultants.com

One attachment • Scanned by Gmail

Letter requesting ...

Customer Services Mon, 16 Oct, 14:52

to me

Hi Con,

I wish to acknowledge receipt of your email which I have forwarded to our Planning Team who will respond to your query directly.

Regards,

Claire Sweeney
Customer Services Advisor
Limerick City and County Council
Merchant's Quay | Limerick V94 EH90
061 556000 |
customerservices@limerick.ie
www.limerick.ie

From: Con Curtin <curtinagri@gmail.com>
Sent: Monday, October 16, 2023 12:32 PM
To: Customer Services <customerservices@limerick.ie>
Subject: [EXTERNAL]Planning Reference 14/276 Ballyfaskin Enterprises Ltd, Ballyfauskeen, Ballylanders, County Limerick

Dear Planning Department

Con Curtin <curtinagri@gmail.com> 14:13 (4 hours ago)

to Customer

Hi

Could you inform the Planning office that I have to respond to RFI from EPA in relation to 14/276 before end of November (and this is after I have requested an extension to the initial time for response)

Con Curtin
Curtin Agricultural Consultants Ltd
12 The Paddocks
Kells Road
Kilkenny
056-7752026
087-2588798
curtinagriculturalconsultants.com

•••

Customer Services 15:03 (3 hours ago)

to me

Good Afternoon Con,

I wish to acknowledge receipt of your email which has been forwarded to the Planning department for their consideration and reply.

Regards,
Darren

Customer Services Adviser
Limerick City and County Council
Merchants Quay
Limerick
V94 EH90

061 556000

From: Con Curtin <curtinagri@gmail.com>
Sent: Friday 17 November 2023 14:13
To: Customer Services <customerservices@limerick.ie>
Subject: Re: [EXTERNAL]Planning Reference 14/276 Ballyfaskin Enterprises Ltd, Ballyfauskeen, Ballylanders, County Limerick

Attachment 3-2 Figure 1(a) Site Layout Plan

Legend

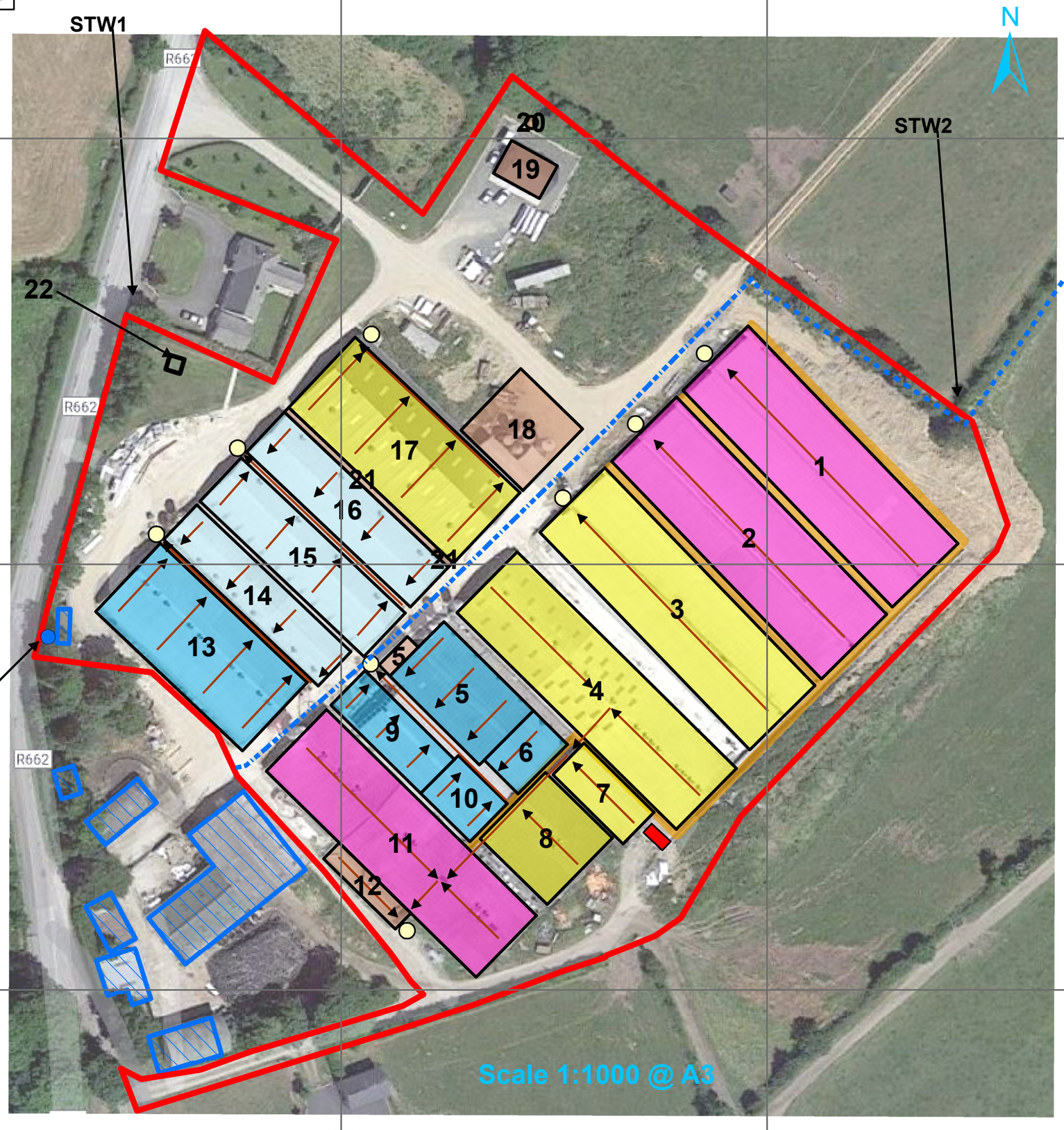
- Well
- Slurry direction
- Storm water
- Site outline
- Existing Buildings
- Slurry off-take point
- Carcass skip
- Uncovered pig walk-ways (soiled water)

Scale : 1:1,000 @ A3

0 50 100 200 300 400 Mete

Attachment 3-2 Figure 1(b) Site Layout Plan

Ref No	Description	Length (m)	Width (m)	Height (m)	Area (m^2)	Depth of tank (m)	Slurry storage (m^3)
1	Finisher house	71.7	21.3	5.1	1527	1.8	2077
2	Finisher house	71.7	21.3	5.1	1527	1.8	2077
3	Dry sow house	71.7	21.3	5.1	1527	1.8	2077
4	Dry sow house	71.7	21.3	5.2	1527	1.8	2077
5	Weaner house	29.3	17.8	4.3	522	1.2	443
6	Weaner house	11.4	16.4	4.3	187	1.2	159
7	Dry sow house	23.6	10.4	4.3	245	1.8	334
8	Dry sow house	21.7	21.5	4.3	467	1.8	635
9	Weaner house	30.2	11.1	4	335	-	285
10	Weaner house	15.5	12.6	4	195	1.2	166
11	Finisher House	69.5	20	5	1390	1.8	1890
12	Loading bay	23	4.6	-	106	-	
13	Weaner house	48.8	21.9	4	1069	1.2	908
14	Farrowing house	51.3	11	3.5	564	1.2	480
15	Farrowing house	52.8	12.8	3.5	676	1.2	575
16	Farrowing house	52.8	12.8	4	676	1.2	575
17	Dry sow house	52.8	22.5	5	1188	1.8	1616
18	Mill Building	20	20	18.3	400	-	
19	Office and staff facilities	11	10	5	110	-	
20	Septic tank	-	-	-	73m^3	-	-
21	Water Harvesting tank and pump house	1.8	52.8	95	110	1.8	-
22	Electrical substation*	4.9	4.4	3	21.7	-	-
		Totals =>			14,260		17,336



Legend

Building type

- Farrowing
- Finnisher
- Dry Sow
- Weaner
- Ancillary building
- Cattle buildings
- Slurry off-take points
- Carcass skip
- Slatted soiled water passage
- Slurry flow
- Storm water pipe
- Open drain
- Site outline

178800.000000 178900.000000 179000.000000 179100.000000

123500.000000 123400.000000 123300.000000

0 25 50 100 150 200 250 300 Meters

Storm Water Map

N

Storm water monitoring (STW1)

Storm water monitoring (STW2)

Storm water via open field drains

Well

Aherlow

Aherlow Tributary

Legend

- Site outline
- Storm water
- Other minor watercourses
- Main watercourses / river

Scale 1:5,000 @ A3

Figure 2: Site Location map

OSi PLACE Map

CURRAGHKILBRAN

Well supplying pig farm (piped along road)

Stormwater discharge

CURRAGHTURK

BALLYFAUSKEEN (ED Anglesborough)

Aherlow tributary

Domestic well supplying owner's and parent's house

Owner's and parent's houses

Legend

- Registered Monuments
- Houses
- NIAH Sites
- Waterbodies
- Storm water
- 1km from boundary
- Site outline
- Study area townlands
- Developer's farm

Scale 1:5,000 @ A3

0 250 500 1,000 1,500 2,000 Meters

Ordnance Survey Ireland
National Mapping Agency

CENTRE COORDINATES:
ITM 578913,623431

PUBLISHED: 09/08/2021

ORDER NO: 50212078_1

MAP SERIES:
1:5,000
1:2,500
1:5,000
1:2,500

MAP SHEETS:
5358
5358-D
5419
5419-B

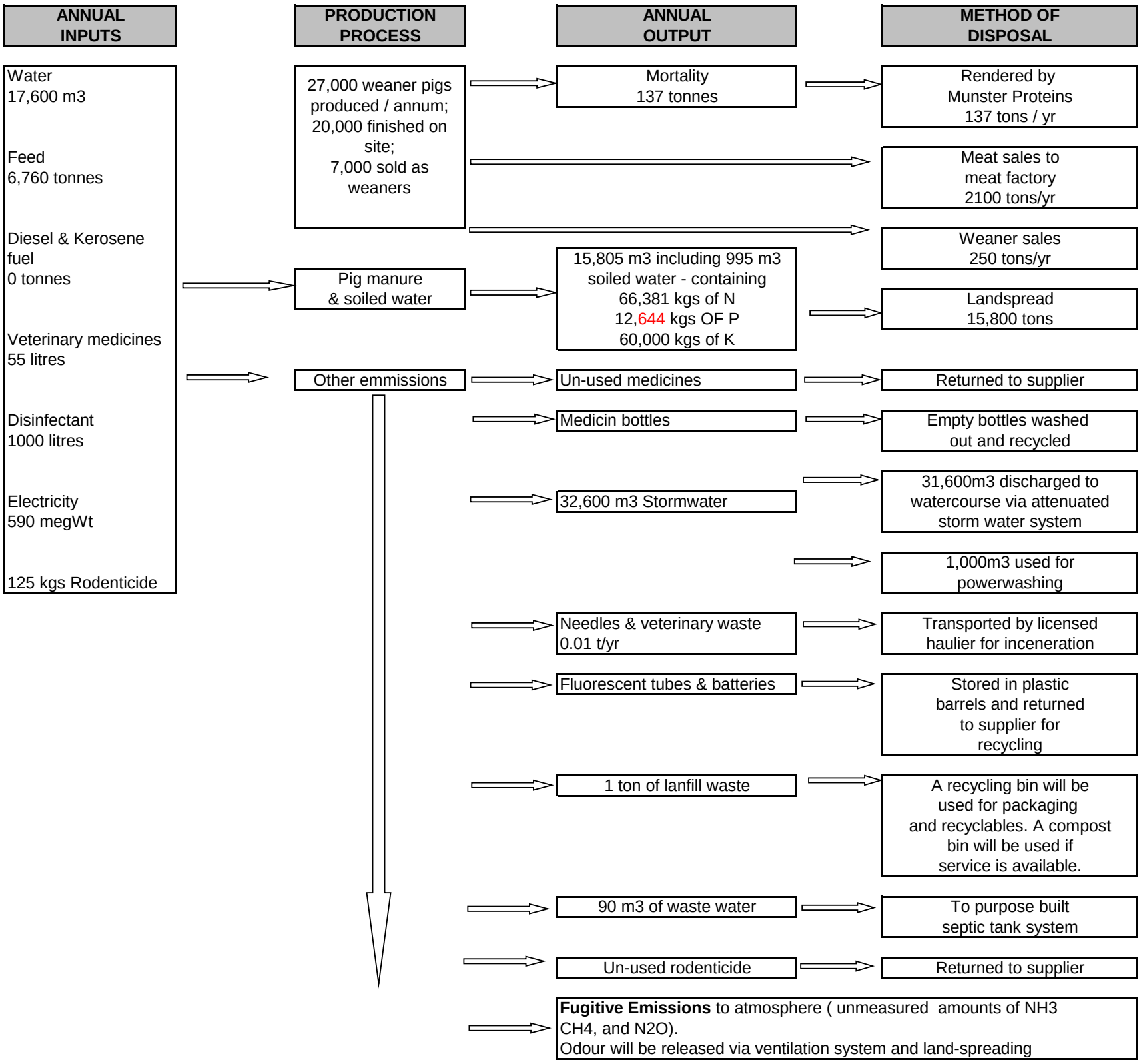
COMPILED AND PUBLISHED BY:
Ordnance Survey Ireland,
Phoenix Park,
Dublin 8,
Ireland.

CAPTURE RESOLUTION:
The map objects are only accurate to the resolution at which they were captured.
Output scale is not indicative of data capture scale.
Further information is available at:
http://www.osi.ie; search 'Capture Resolution'

OUTPUT SCALE: 1:5,000

LEGEND:
http://www.osi.ie;
search 'Large Scale Legend'

ATTACHMENT-4-8-1-OPERATIONAL REPORT



Unit Operations

Sow gestation period is 115 days - kept in dry sow houses during this period. Sow moved to farrowing houses prior to giving birth to approx. 11 live piglets. Each sow consumes 1.3tons of meal per annum. Piglets are weaned after 28 days and moved to weaner houses. The weaned pig will remain in the weaner houses for 8 weeks. The weaner pig will consume 58kgs and kgs of weaner ration. At approx. 38kgs liveweight the weaner pig is moved to the finisher houses. It will remain in the finisher houses for approx. 10.5 weeks until 100 - 110 kgs liveweight. Each finisher will consume 200kgs of feed.

Emissions

Each sow and weaned pigs place (breeding part of enterprise) produces 0.173m3 of slurry (Table 1 of SI 605 of 2017). Each finishing pig place produces 0.028m3 of slurry per week. Therefore 14,810m3 of pig slurry is produced each year plus 995m3 of sioled water = €15,805m3 of slurry in total. According to the EPA Intensive Agriculture PRTR Emissions calculation spreadsheet tool the 167, 833, 5, 5357 and 3,957 lactating sows, dry sows, weaners and production pigs will produce 16.4tons, 124.3tons and tons of NH3, CH4 and N2O - assuming a 20% mitigation in NH3 due to low proteinn diets. These pigs will produce 119,193 odour units.

Approx. 22,400m2 of hard standing produces approx. 32,600m3 of stormwater which is attenuated in tank Ref No 21 before discharging to a watercourse. Approx. 1,000m3 of the the rainwater in tank No 21 is used for power washing.

Housing and slurry storage

There is 14,238m2 of animal housing on site. There is 17,336m3 of slurry storage.

Hours of operation

This pig farm will house pigs 24 hours every day of the year. However, working hours are from 0700 to 1700 hours Monday to Friday and 0700 to 1200 huors on Saturdays and Sundays.

Domestic waste

The office toilets are treated in a septic tank system.

EPA Application Form

7.6.2(a) - Landspreading Controls – (Agri) - Attachment

Operational Report for the Management of Organic Fertiliser

Organisation Name:	Ballyfaskin Enterprises Ltd
Application I.D.:	LA007359

Amendments to this Application Form Attachment

Version No.	Date	Amendment since previous version	Reason
V.1.0	July 2017	N/A	Online application form attachment
As above	Mar 2018	Identification of required fields	Assist correct completion of attachment

7.6.2 Additional Information: Emissions to Ground & Landspreading

With regards to manure / poultry litter (organic fertiliser) produced by the activity, the applicant should supply details of the nature, quantity, storage facilities, end-use and records of any organic fertiliser produced, or proposed to be produced by the activity, having regard to the European Union (Good Agricultural Practice for Protection of Waters) Regulations 2014, S.I. No. 31 of 2014.

Tables 7.6.2(i), 7.6.2(ii) and 7.6.2(iii) should be completed as applicable.

Any additional relevant information should be included in Table 7.6.2(iv).

7.6.2(i) Organic Fertiliser: Nature and Quantities

State the quantity of organic fertiliser produced by the activity per annum.

	Quantity produced per annum	
	Existing	**Proposed**
Pig Rearing Farms[1]:		
Pig slurry (m^3)	**15,681**	**15,805**
Farm Yard Manure (m^3)	**0**	**0**
Poultry Farms:		
Poultry manure (m^3)		
Washwater (m^3)		

[1] As per European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014, (Nitrates Regulations):

- "farmyard manure" means a mixture of bedding material and animal excreta in solid form arising from the housing of cattle, sheep and other livestock excluding poultry;
- "slurry" includes—

  (*a*) excreta produced by livestock while in a building or yard, and

  (*b*) a mixture of such excreta with rainwater, washings or other extraneous material or any combination of these, of a consistency that allows it to be pumped or discharged by gravity at any stage in the handling process but does not include soiled water.

7.6.2(ii) Organic Fertiliser: Storage capacity

Record the on-site storage capacity available for organic fertiliser:

Where an expansion / development is proposed, record the existing and the proposed on-site storage capacity available for organic fertiliser:

(a) Slurry/Washwater Storage Capacity:

Tank	Construction type and Year of construction	Length (m)	Breadth (m)	Depth[2] (minus freeboard of 200/300mm)	Capacity (m^3)
1		71.7	21.3	1.4	2077
2		71.7	21.3	1.4	2077
3		71.7	21.3	1.4	2077
4		71.7	21.3	1.4	2077
5		29.3	17.8	0.8	443
6		11.4	16.4	0.9	159
7		23.6	10.4	1.4	334
8		21.7	21.5	1.4	635
9		30.2	11.1	0.9	285
10		15.5	12.6	0.9	166
11		69.5	20	1.4	1890
13		48.8	21.9	0.8	908
14		51.3	11	0.9	480
15		52.8	12.8	0.9	575
16		52.8	12.8	0.9	575
17		52.8	22.5	1.4	1616
				Total capacity of storage tanks:	**17,336**

(b) Poultry Manure/Farmyard Manure Storage Capacity

Record the on-site storage capacity available for organic fertiliser:

Where an expansion / development is proposed, record the existing and the proposed on-site storage capacity available for organic fertiliser:

Storage shed/Area	Length (m)	Breadth (m)	Height (m)	Capacity(m^3)
N/A				
			Total capacity of storage sheds/area:	

(c) Total storage capacity for organic fertiliser generated by the activity

	Has 26 weeks storage capacity been provided on-site?	
	Existing	**Proposed**
Pig Rearing:		

[2] As per European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014, (Nitrates Regulations):

- 200mm freeboard must be provided in all covered tanks and 300mm freeboard in all uncovered tanks.

Pig slurry (m^3)	**Y**	**Y**
Farm Yard Manure (m^3)	**N/A**	**N/A**
Poultry Farms:		
Poultry manure (m^3)		
Washwater (m^3)		
Where 26 weeks storage is not provided on-site, describe the arrangements in place to ensure compliance with the Nitrates Regulations (SI No 31 of 2014)		

_____

7.6.2(iii) Organic Fertiliser: End Use

(a) Washwater (poultry applications only)

Where washwater is used as an organic fertiliser on land, provide the following:

Where an expansion / development is proposed, record the existing and the proposed arrangements:

	Existing	Proposed
Area of land on which washwater (organic fertiliser) may be used as a fertiliser	5,543 Ha	5,543 Ha
Location of lands on which washwater (organic fertiliser) may be used as a fertiliser (townland & county)	**Townland**	**Townland**
	1. Killeenagarriff 84ha, Co Limerick	1. Killeenagarriff 84ha, Co Limerick
	2. Highpark 180ha, Co Limerick	2. Highpark 180ha, Co Limerick
	3. Caherconlish 35ha, Co Limerick	3. Caherconlish 35ha, Co Limerick
	4. Fedamore 49ha, Co Limerick	4. Fedamore 49ha, Co Limerick
	5. Ballybricken North 68ha, Co Limerick	5. Ballybricken North 68ha, Co Limerick
	6. Ballybricken West 53ha, Co Limerick	6. Ballybricken West 53ha, Co Limerick
	7. Ballybricken East 48ha, Co Limerick	7. Ballybricken East 48ha, Co Limerick
	8. Ballybricken South 111ha, Co Limerick	8. Ballybricken South 111ha, Co Limerick
	9. Caherelly East 211ha, Co Limerick	9. Caherelly East 211ha, Co Limerick
	10. Caherelly West 85 ha, Co Limerick	10. Caherelly West 85 ha, Co Limerick
	11. Kilteely 53 ha, Co Limerick	11. Kilteely 53 ha, Co Limerick
	12. Monearmore 6 ha, Co Limerick	12. Monearmore 6 ha, Co Limerick
	13. Cullen 15 ha, Co Tipperary	13. Cullen 15 ha, Co Tipperary
	14. Gortdrum 22 ha, Co Tipperary	14. Gortdrum 22 ha, Co Tipperary
	15. Ballyryan East 33 ha, Co Tipperary	15. Ballyryan East 33 ha, Co Tipperary
	16. Milltown (ED Ballykisteen) 20 ha, Co Limerick	16. Milltown (ED Ballykisteen) 20 ha, Co Limerick
	17. Bruff 74 ha, Co Limerick	17. Bruff 74 ha, Co Limerick

	18. Knockainy West 294 ha, Co Limerick	18. Knockainy West 294 ha, Co Limerick
	19. Knockainy East 23 ha, Co Limerick	19. Knockainy East 23 ha, Co Limerick
	20. Kilfrush 249 ha, Co Limerick	20. Kilfrush 249 ha, Co Limerick
	21. Knocklong 44 ha, Co Limerick	21. Knocklong 44 ha, Co Limerick
	22. Knocklong West 212 ha, Co Limerick	22. Knocklong West 212 ha, Co Limerick
	23. Knocklong East 107 ha, Co Limerick	23. Knocklong East 107 ha, Co Limerick
	24. Ballycurrane 95 ha, Co Tipperary	24. Ballycurrane 95 ha, Co Tipperary
	25. Bartoose 135 ha	25. Bartoose 135 ha
	26. Emly 43 ha, Co Tipperary	26. Emly 43 ha, Co Tipperary
	27. Ballylooby 153 ha, Co Limerick	27. Ballylooby 153 ha, Co Limerick
	28. Lattin North 94 ha, Co Tipperary	28. Lattin North 94 ha, Co Tipperary
	29. Lattin West 66 ha, Co Tipperary	29. Lattin West 66 ha, Co Tipperary
	30. Lattin East 62 ha, Co Tipperary	30. Lattin East 62 ha, Co Tipperary
	31. Mooresfort 275 ha, Co Tipperary	31. Mooresfort 275 ha, Co Tipperary
	32. Kilross 188 ha, Co Tipperary	32. Kilross 188 ha, Co Tipperary
	33. Ballyfroota 173 ha, Co Limerick	33. Ballyfroota 173 ha, Co Limerick
	34. Galbally 74 ha, Co Limerick	34. Galbally 74 ha, Co Limerick
	35. Corderry 170 ha, Co Tipperary	35. Corderry 170 ha, Co Tipperary
	36. Park (ed galbally) 131 ha, Co Limerick	36. Park (ed galbally) 131 ha, Co Limerick
	37. Spittle (ED Ballylanders) 199 ha, Co Limerick	37. Spittle (ED Ballylanders) 199 ha, Co Limerick
	38. Curraghkilbran 108 ha, Co Limerick	38. Curraghkilbran 108 ha, Co Limerick
	39. Curraghturk 103 ha, Co Limerick	39. Curraghturk 103 ha, Co Limerick
	40. Ballyfauskeen 209 ha, Co Limerick	40. Ballyfauskeen 209 ha, Co Limerick
	41. Cullane North 149 ha, Co Limerick	41. Cullane North 149 ha, Co Limerick
	42. Ballyduff 93 ha, Co Limerick	42. Ballyduff 93 ha, Co Limerick
	43. Cullane Middle 166 ha, Co Limerick	43. Cullane Middle 166 ha, Co Limerick
	44. Cullane South 209 ha, Co Limerick	44. Cullane South 209 ha, Co Limerick
	45. Spittle (ED Darragh) 86 ha, Co Limerick	45. Spittle (ED Darragh) 86 ha, Co Limerick
	46. Kilglass 204 ha, Co Limerick	46. Kilglass 204 ha, Co Limerick
	47. Shanbally 110 ha, Co Tipperary	47. Shanbally 110 ha, Co Tipperary
	48. Kilcoran 178 ha, Co Tipperary	48. Kilcoran 178 ha, Co Tipperary
Are lands on which washwater (organic fertiliser) may be used	N	N

as a fertiliser within ownership of applicant		

(b) Manure[3] /Slurry – complete all relevant parts

i. In which of the following ways is/will organic fertiliser (manure/slurry) be used when it leaves the installation? (select all that apply)

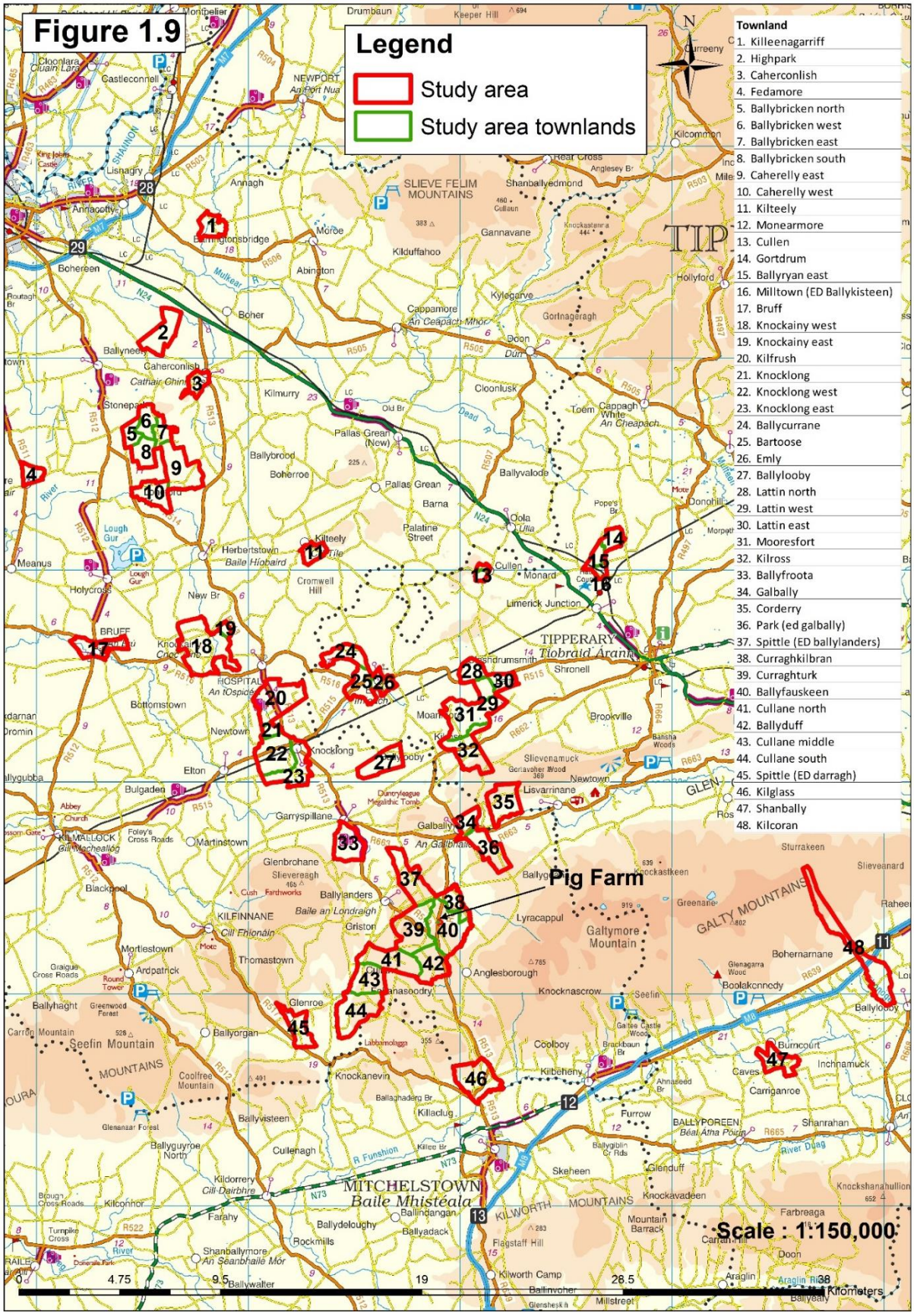
	Existing		**Proposed**	
On land as fertiliser	Y		Y	
Mushroom compost production	N		N	
Anaerobic digestion	N		N	
Other	N	Specify and describe how and where the organic fertiliser will be used:	N	Specify and describe how and where the organic fertiliser will be used:

*ii. Where organic fertiliser (manure/slurry) is/will be removed from the installation **directly** to farms **for use as fertiliser on land**, provide the following for each farm:*

Farm code	**Location (townland and county)**	**Import capacity (m^3) (Refers to Townlands in the Study Area)**
N/A	1. Killeenagarriff 84ha, Co Limerick	842
N/A	2. Highpark 180ha, Co Limerick	1796
N/A	3. Caherconlish 35ha, Co Limerick	350
N/A	4. Fedamore 49ha, Co Limerick	490
N/A	5. Ballybricken North 68ha, Co Limerick	683
N/A	6. Ballybricken West 53ha, Co Limerick	534
N/A	7. Ballybricken East 48ha, Co Limerick	476
N/A	8. Ballybricken South 111ha, Co Limerick	1114
N/A	9. Caherelly East 211ha, Co Limerick	2114
N/A	10. Caherelly West 85 ha, Co Limerick	850
N/A	11. Kilteely 53 ha, Co Limerick	526
N/A	12. Monearmore 6 ha, Co Limerick	56
N/A	13. Cullen 15 ha, Co Tipperary	148
N/A	14. Gortdrum 22 ha, Co Tipperary	224
N/A	15. Ballyryan East 33 ha, Co Tipperary	328
N/A	16. Milltown (ED Ballykisteen) 20 ha, Co Limerick	205
N/A	17. Bruff 74 ha, Co Limerick	737
N/A	18. Knockainy West 294 ha, Co Limerick	2942
N/A	19. Knockainy East 23 ha, Co Limerick	227
N/A	20. Kilfrush 249 ha, Co Limerick	2489
N/A	21. Knocklong 44 ha, Co Limerick	438
N/A	22. Knocklong West 212 ha, Co Limerick	2122
N/A	23. Knocklong East 107 ha, Co Limerick	1075

[3] Pig Manure or Poultry Manure

N/A	24. Ballycurrane 95 ha, Co Tipperary	950
N/A	25. Bartoose 135 ha	1348
N/A	26. Emly 43 ha, Co Tipperary	430
N/A	27. Ballylooby 153 ha, Co Limerick	1525
N/A	28. Lattin North 94 ha, Co Tipperary	938
N/A	29. Lattin West 66 ha, Co Tipperary	657
N/A	30. Lattin East 62 ha, Co Tipperary	620
N/A	31. Mooresfort 275 ha, Co Tipperary	2753
N/A	32. Kilross 188 ha, Co Tipperary	1876
N/A	33. Ballyfroota 173 ha, Co Limerick	1733
N/A	34. Galbally 74 ha, Co Limerick	741
N/A	35. Corderry 170 ha, Co Tipperary	1701
N/A	36. Park (ed galbally) 131 ha, Co Limerick	1305
N/A	37. Spittle (ED Ballylanders) 199 ha, Co Limerick	1988
N/A	38. Curraghkilbran 108 ha, Co Limerick	1081
N/A	39. Curraghturk 103 ha, Co Limerick	1026
N/A	40. Ballyfauskeen 209 ha, Co Limerick	2093
N/A	41. Cullane North 149 ha, Co Limerick	1494
N/A	42. Ballyduff 93 ha, Co Limerick	935
N/A	43. Cullane Middle 166 ha, Co Limerick	1664
N/A	44. Cullane South 209 ha, Co Limerick	2086
N/A	45. Spittle (ED Darragh) 86 ha, Co Limerick	863
N/A	46. Kilglass 204 ha, Co Limerick	2038
N/A	47. Shanbally 110 ha, Co Tipperary	1096
N/A	48. Kilcoran 178 ha, Co Tipperary	1779
Total Import capacity (m^3)		55,430 (Refers to Townlands in the Study Area)
Brief Description of how import capacities were calculated:		In accordance with S1 605 of 2017



*iii. Where organic fertiliser (manure) is/will be removed from the installation by a Department of Agriculture, Food and the Marine registered **contractor**, provide the following:*

Name of contractor			
DAFM registration number	None (Herd number is confidential)		
Total amount of organic fertiliser contractor agrees to remove from the installation per annum **Attach either:** **1. Letter of confirmation from contractor confirming this, and** **2. Copy of Record 3[5] from previous year (where relevant)** [4]	Not fixed		
Identify the use proposed by the contractor for organic fertiliser taken from the installation:	Use on land	Y	
	Mushroom Compost production	N	Specify facility
	Anaerobic digester	N	Specify facility
	Other	N	Specify facility
Documentation maintained at the installation in relation to movement of organic fertiliser off site	Record 3[5]	Y	
	Commercial[6] documents	N	
	Other	N (specify)	

[4] A copy of the Record 3 form (as required under article 23 of the European Union (Good Agricultural Practice for Protection of waters) Regulations 2014) for the previous year. For new developments, where no Record 3 forms exist yet, the applicant should supply details of land with an organic fertiliser demand available for landpreading, as per Table xxx above.

[5] Record 3 is a 'Record of Movement of Organic Fertilisers' required to comply with the European Union (Good Agricultural Practice for Protection of Waters) regulations 2014. The Record 3 form must be submitted before the end of each year. A copy of the Record 3 must be maintained by both the exporter and the importer.

[6] As per European Animal By-Product Regulations (EC Regulation No 1069/2009 and Commission Regulation 142/2011), (Animal By-Product Regulations).

*iv. Where organic fertiliser (manure/slurry) is/will be removed from the installation **for use other than as a fertiliser on land or by a DAFM registered contractor,** provide the following:*

Total amount of organic fertiliser exported from the installation	n/a		
Proposed outlet for organic fertiliser	Mushroom Compost production	n/a	Specify facility
	Anaerobic digester	n/a	Specify facility
	Other	n/a	Specify facility
Documentation maintained at the installation in relation to movement of organic fertiliser off site	Record 3[7]	n/a	
	Commercial[8] documents	n/a	

7.6.2(iv) Organic Fertiliser: Any other relevant information

Details regarding any other relevant information: None

[7] Record 3 is a 'Record of Movement of Organic Fertilisers' required to comply with the European Union (Good Agricultural Practice for Protection of Waters) regulations 2014. The Record 3 form must be submitted before the end of each year. A copy of the Record 3 must be maintained by both the exporter and the importer.

[8] As per European Animal By-Product Regulations (EC Regulation No 1069/2009 and Commission Regulation 142/2011), (Animal By-Product Regulations)

Odour Impact Assessment – Integrated Pig Farm at Ballylanders, Limerick

Prepared for:

Ballyfaskin Enterprises Ltd

February 2023

Final

Prepared by:

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Contents

Tables

Figures

Contour Plates

Glossary

Term	Definition
g/s	gram per second
kg	kilogram
kg/m³	Kilogram per cubic meter
km	kilometre
km/hr	kilometre per hour
m	metre
m/s	metres per second
m^2	square metres
m^3	cubic metres
m^3/s	cubic metres per second
m³/hr	cubic metres per hour
mg	milligram
Z_0	roughness length
ou_E/m^3	European odour unit per cubic meter
ou_E/s	European odour unit per second
µg/m³	micrograms per cubic meter
Abbreviations	**Definition**
AG4	Air Guidance 4
BAT	Best available techniques
EPA	Environmental Protection Agency
EF	Emission factor
EU	European Union

EXECUTIVE SUMMARY

Ballyfaskin Enterprises commissioned Katestone to complete an odour impact assessment (OIA) for a pig farm located at Ballylanders, County Limerick (Site).

Ballyfaskin Enterprises proposes to:

- Increase pig numbers with the addition of four (4) rows of new housing units immediately northeast of the existing housing units at the Site.
- Reconfigure the exhausts of naturally ventilated sheds at the Site with mechanically ventilated chimney stacks to reduce the impact of emissions exhausted to the atmosphere.

The assessment is required to determine the potential impact of odorous emissions from the proposed development at the pig farm on nearby residential locations. The assessment will be submitted as part of planning and licensing applications for the pig farm.

The odour assessment was conducted in accordance with recognised techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). The dispersion model, CALPUFF, was used to predict ground-level concentrations of odour across the model domain due to the pig farm. The assessment of odour has also been conducted in accordance with EPA's instruction note for the assessment of odour emissions from intensive agriculture pig installations (EPA, 2022).

Final Report Findings

The odour modelling assessment found that the predicted concentrations of odour at all sensitive receptors are under EPA limits and, therefore, **comply** with odour criterion recommended by EPA for existing pig farms of $5.0ou_E/m^3$ at all modelled sensitive receptor locations.

1. INTRODUCTION

Katestone Environmental Pty Ltd (Katestone) was commissioned by Ballyfaskin Enterprises Limited (Ballyfaskin Enterprises) to complete an odour impact assessment of a pig farm located at Ballylanders, County Limerick (Site).

Ballyfaskin Enterprises proposes to:

- Increase pig numbers with the addition of four (4) rows of new housing units immediately northeast of the existing housing units at the Site.
- Reconfigure the exhausts of naturally ventilated sheds at the Site with mechanically ventilated chimney stacks to reduce the potential impact of emissions exhausted to the atmosphere.

The odour impact assessment was used to inform the design of the pig farm to ensure concentrations of odour due to emissions from onsite sources are within the acceptable odour level defined by the Environmental Protection Agency (EPA) in Ireland at nearby sensitive receptors.

The current pig farm at the Site is operated in accordance with the requirements of an Industrial Emissions License (IEL). EPA issued an Integrated Pollution Prevention and Control (IPPC) licence (Register number P0915-01) for the housing units on 10 June 2013 (EPA, 2013a). The IPPC licence was amended to an IEL, which was issued by EPA to Ballyfaskin Enterprises on 16 December 2013 (EPA, 2013b). The licence boundary of the Site will have to be adjusted to incorporate the proposed new housing units.

This odour impact assessment was undertaken using dispersion modelling techniques. The dispersion modelling has been completed in accordance with the requirements of EPA's Air Dispersion Modelling Guidance Note (AG4). The assessment of odour has also been conducted in accordance with EPA's instruction note for the assessment of odour emissions from intensive agriculture pig installations (EPA, 2022).

2. OVERVIEW OF THE PIG FARM

The pig farm is located approximately 2.2 km east of the village of Ballylanders, Co. Limerick. It is located in an area of complex terrain being close to the lowest point of the valley. The Site is surrounded by elevated terrain, predominantly the Galtee Mountains. There are number of rural residences in the vicinity of the Site. The proposed licence boundary of the Site and its environs are presented in Figure 1. All pig housing units will be located within the proposed licence boundary of the Site.

A Site plan illustrating the layout of the existing housing units and proposed housing units is presented in Figure 2.

The old housing units currently have the following maximum animal holding capacity:

- 1,038 Sows
- 5,360 weaners
- 3,892 Fattener pigs (Growers and finishers).

The new housing units will have maximum animal holding capacity of 2,592 fattener pigs.

A number of the existing housing units at the Site are naturally ventilated. As part of the proposed development, emissions from all housing units will be captured and ventilated through elevated chimney stacks. This will significantly reduce the potential impact of emissions in the vicinity of the Site.

The following buildings identified in Figure 2 are currently naturally ventilated and will be upgraded with a mechanical ventilation system as part of the proposed development.

- Building 1
- Building 2
- Building 3
- Building 7.

Figure 1 **Ballyfaskin pig farm proposed Site boundary (red line) and the surrounding environment**

Figure 2 **Ballyfaskin pig farm Site plan – existing and proposed housing units and existing and proposed chimney stacks**

3. REGULATORY FRAMEWORK AND ASSESSMENT CRITERIA

3.1 *Environmental Protection Agency Acts 1992 and 2003*

The *Environmental Protection Agency Act 1992 (EPA Act)* and Part 2 of the *Protection of the Environment Act 2003* are collectively referred to as the *Environmental Protection Agency Acts 1992 and 2003*. These Acts provide for the management of air emissions from activities (meaning any process, development or operation) that are listed in the First Schedule of the Acts.

Section 4 (2) of the *Environmental Protection Agency Acts 1992 and 2003* defines Air Pollution as follows:

> *"…the direct or indirect introduction to an environmental medium, as a result of human activity, of substances, heat or noise which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment, and includes -*
>
> *(a) 'air pollution' for the purposes of the Air Pollution Act 1987,*
>
> *(b) ……..*
>
> *(c) ……."*

The *Air Pollution Act 1987* (AP Act) provides for the control of air pollution and other matters connected with air pollution. Under the AP Act 'pollutant' means any substance that is specified in the First Schedule or any other substance (including a substance which gives rise to odour) or energy which, when emitted into the atmosphere either by itself or in combination with any other substance, may cause air pollution.

Section 4 of the AP Act defines air pollution as follows:

> *"Air pollution" in this Act means a condition of the atmosphere in which a pollutant is present in such a quantity as to be liable to —*
>
> *(i) be injurious to public health, or*
>
> *(ii) have a deleterious effect on flora or fauna or damage property, or*
>
> *(iii) impair or interfere with amenities or with the environment."*

Section 24 of the AP Act details the obligations of the occupier of a premises in respect to preventing emissions, nuisance and what constitutes defences against prosecution:

> *(1) The occupier of any premises, other than a private dwelling, shall use the best practicable means to limit and, if possible, to prevent an emission from such premises.*
>
> *(2) The occupier of any premises shall not cause or permit an emission from such premises in such a quantity, or in such a manner, as to be a nuisance.*
>
> *(3) In any prosecution for a contravention of this section, it shall be a good defence to establish that—*
>
> *(a) the best practicable means have been used to prevent or limit the emission concerned, or*
>
> *(b) the emission concerned was in accordance with a licence under this Act, or*
>
> *(c) the emission concerned was in accordance with an emission limit value, or*

(d) the emission concerned was in accordance with a special control area order in operation in relation to the area concerned, or

(e) in the case of an emission of smoke, the emission concerned was in accordance with regulations under section 25, or

(f) the emission did not cause air pollution.

Section 75 (1) of the *Environmental Protection Agency Acts 1992 and 2003* requires the EPA to publish reasonable and desirable quality objectives to protect the environment, namely:

"The Agency shall, in relation to any environmental medium and without prejudice to its functions under section 103, specify and publish quality objectives which the Agency considers reasonable and desirable for the purposes of environmental protection."

3.2 Odour

In 2001, the EPA issued an assessment framework that "*aims to define a set of criteria for odour exposure to achieve a common environmental quality objective in licencing procedures"* (EPA, 2001). This framework is specific to intensive pig units; however, in the absence of other environmental quality objectives specified by EPA, the criterion for odour exposure to intensive pig units has been adopted for this assessment. The Environmental Quality criteria are:

- *Target value:* $C_{98,\ 1\text{-}hour} \leq 1.5\ ou_E/m^3$
    - *The target value provides a general level of protection against odour annoyance for the general public, aiming to limit the percentage of people experiencing some form of odour-induced annoyance to 10% or less. The target value is to be used as an environmental quality target for all situations.*
    - *The target value is achieved when the calculated odour exposure for all locations of odour sensitive receptors is less than an hourly average odour concentration of 1.5* ou_E/m^3 *in 98% of all hours in an average meteorological year.*
- *Limit value for new pig production units:* $C_{98,\ 1\text{-}hour} \leq 3.0\ ou_E/m^3$
    - *The limit value for new pig production units provides a minimum level of protection against odour annoyance, aiming to limit the percentage of those experiencing some form of odour-induced annoyance to 10% or less in the general public, assuming some degree of acceptance of the rural nature of their living environment.*
    - *The limit value for new pig production units shall not be exceeded in the vicinity of new pig production units to ensure a minimum environmental quality. The limit value for new pig production units is complied with when for all locations of odour sensitive receptors the calculated odour exposure is less than an hourly average odour concentration of 3.0* ou_E/m^3 *in 98% of all hours in an average meteorological year.*
- *Limit value for existing pig production units:* $C_{98,\ 1\text{-}hour} \leq 6.0\ ou_E/m^3$
    - *The limit value for existing pig production units provides a minimum level of protection against odour annoyance, aiming to limit the percentage of people experiencing some form of odour-induced annoyance to 10% or less*
    - *The limit value for existing pig production units shall not be exceeded in the vicinity of existing pig production units to ensure the minimum environmental quality in an agricultural setting. A phased plan must be made to reduce the odour impact, with time, to the limit value for new pig production units and, eventually, the target value. The limit value for existing production units is complied with when for all locations of odour sensitive receptors the calculated odour exposure*

is less than an hourly average odour concentration of 6.0 ou_E/m^3 in 98% of all hours in an average meteorological year.

In 2020, EPA released an updated version of its dispersion modelling guidance titled Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (EPA, 2020a). AG4 includes an appendix that describes *Relevant Odour Standards*. It states:

Currently there is no general statutory odour standard in Ireland relating to industrial installations. The EPA(53) has issued guidance specific to intensive agriculture which has outlined the following standards:

- *Target value for new pig-production units of 1.5 OUE/m3 as a 98th%ile of one hour averaging periods,*
- *Limit value for new pig-production units of 3.0 OUE/m3 as a 98th%ile of one hour averaging periods,*
- *Limit value for existing pig-production units of 6.0 OUE/m3 as a 98th%ile of one hour averaging periods.*

Guidance from the UK (EA, 2011, and adapted for Irish EPA use) recommends that odour standards should vary from 1.5 – 6.0 OUE/m3 as a 98th%ile of one hour averaging periods at the worst-case sensitive receptor based on the offensiveness of the odour and with adjustments for local factors such as population density(54). A summary of the indicative criterion is given below in Table A4:

In 2022, EPA issued a document titled "Instruction note for the assessment of odour emissions from Intensive Agriculture pig installations" (EPA, 2022) which is referred to here as the EPA 2022 Pig Instruction Note. Its stated objective is to:

"provide applicants with a methodology on how to screen for and assess odour impacts from the licensable intensive agriculture pig sector, as well as assisting in how applicants can demonstrate compliance with BAT 13 (to reduce odour emissions and / or odour impact) of the Commission Implementing Decision (CID) 2017/302. This instruction note replaces the EPA's 2001 'Odour Impacts and Odour Emission Control Measures for Intensive Agriculture' guidance document and screening methodology.".

The EPA 2022 Pig Instruction Note sets out acceptable odour levels, below which licenced Sites can operate without generating unacceptable odour pollution at sensitive receptors. According to the EPA 2022 Pig Instruction Note, the acceptable odour levels specific to intensive agriculture are defined as follows:

- 3.0 ou_E/m^3 for new pig-production units
- 5.0 ou_E/m^3 for existing pig-production units (includes Sites licensed by the EPA between 2001 and 15th February 2017 only)
- 6.0 ou_E/m^3 for existing pig-production units (includes Sites licensed by the EPA prior to 2001 and not reviewed since this date only).

The acceptable odour levels are based on the 98th percentile of hourly mean concentrations of odour modelled over a year at the odour-sensitive locations.

The EPA 2022 Pig Instruction Note states that applicability of the above levels will be at odour-sensitive locations only. Note, for the purposes of this instruction note, the applicant's dwelling and farmyard are not considered to be odour sensitive locations. Where there are no third-party odour-sensitive receptors present, a higher odour level may be considered acceptable e.g., at the applicant's dwelling, farmyard, or countryside.

The odour level that is applicable to the pig farm is 5.0 ou_E/m^3 reported at the 98th percentile of hourly mean concentrations of odour modelled over a year at the odour-sensitive locations.

4. EXISTING ENVIRONMENT

This section presents information on the existing environment in the vicinity of the Site, within the dispersion modelling domain and within the meteorological modelling domain. The meteorological modelling domain has been characterised using geophysical data (terrain and land use) and meteorological data.

The extents of the dispersion modelling domain were determined based on the locations of the nearest sensitive odour receptors in all directions from the Site. If the dispersion modelling assessment shows compliance with the acceptable odour level at the nearest sensitive receptors it indicates that odour levels will be lower at sensitive receptor locations further afield

4.1 Local terrain and land-use

The Site is in a remote rural location surrounded by pasture. There is a small amount of forestry located between the pig farm and the village of Ballylanders approximately 700 m west of the pig farm.

The pig farm is located in an area of complex terrain that will have significant effects on the meteorological patterns in the vicinity of the of the Site. The location of the Site in a valley and proximity to numerous hills and mountain ranges around the Site will result in unique weather patterns.

The pig farm is located in a valley at an elevation of approximately 170 m. The valley is bound by a number of mountains and hills including:

- The Galtee Mountains that rise to almost 800 m, 6 km east of the pig farm
- The Moanour Mountain that rises to approximately 370 m, 7.8 km northeast of the pig farm
- The Slievereagh Mountains that rise to 465 m, 6.7 km northwest of the pig farm
- Fear Breagach Mountains that rises to 362 m, 8.7 km northwest of the pig farm
- The Ballyhoura Mountains that rise to 528 m 13 km southwest of the pig farm
- Elevated land that runs west to east between the Ballyhoura Mountains and the Galtee Mountains south of the pig farm.

The complexity of the terrain of the modelling domain is presented as:

- A 2-dimenstional surface plot in in Figure 3
- A 3-dimenstional surface plot in in Figure 4.

The mountains and hills on the modelling domain will affect synoptic scale wind patterns in the area by:

- Blocking wind coming from certain directions
- Channelling winds along the valleys created by the hills and mountains
- Creating very specific local air flows under low windspeed conditions due to katabatic and anabatic air flows created by the slopes of the complex terrain.

The predominant valley in which the pig farm is located is created by the Ballyhoura Mountains and Galtee Mountains, which result in a north-south oriented valley.

The complexities of the Site in terms of local terrain and proximity to multiple water bodies are likely to have an important effect on dispersion conditions near the Site and across the modelling domain.

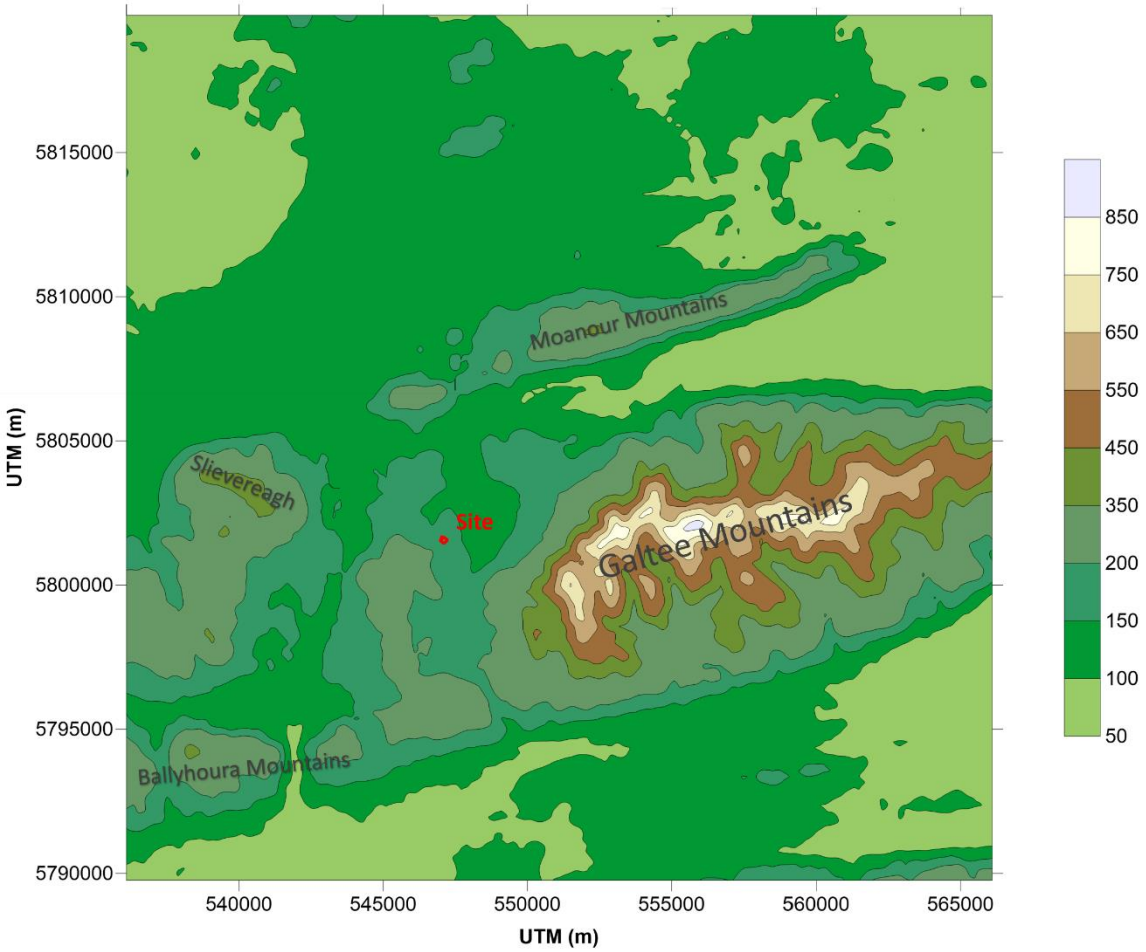

Figure 3 **2-dimensional terrain of the modelled domain**

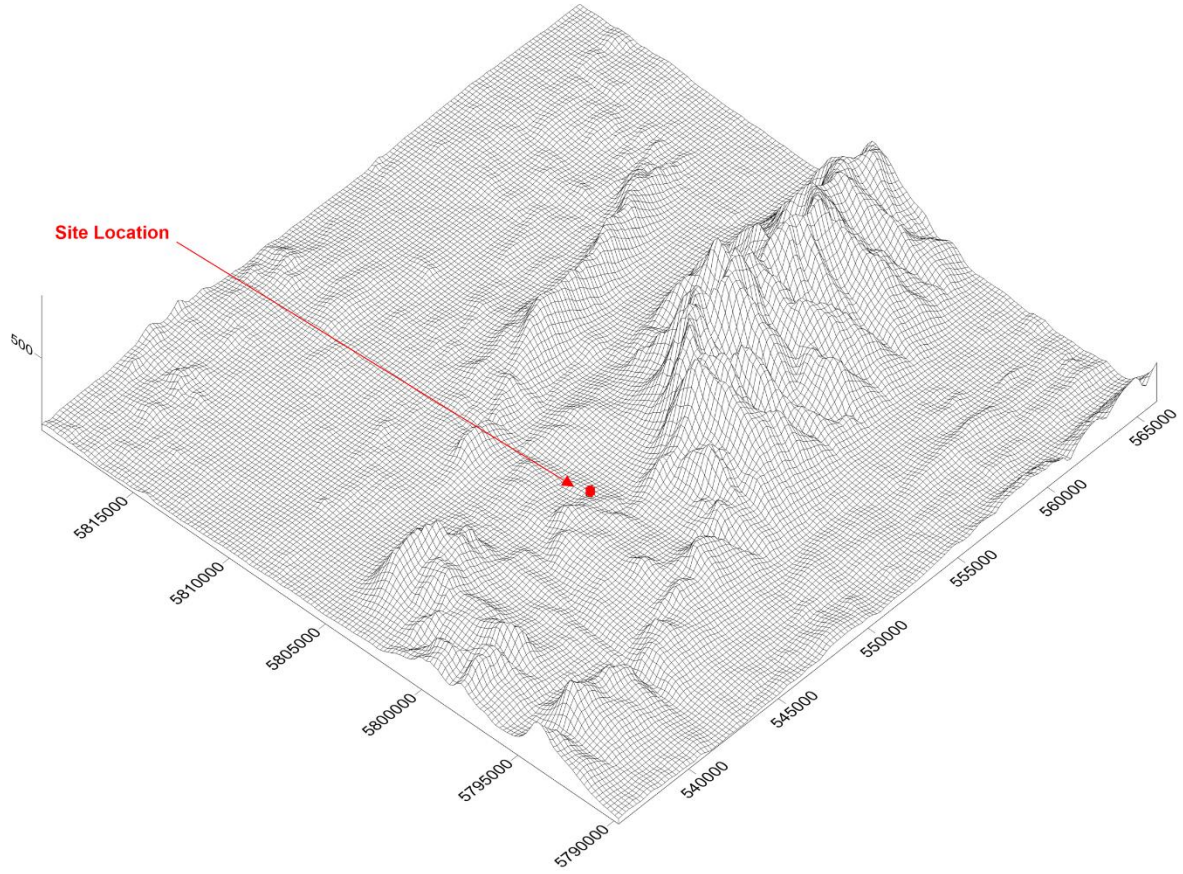

Figure 4 3-dimensional terrain of the modelled domain

4.2 Meteorology

Wind speed and wind direction are important parameters for the transport and dispersion of air pollutants from a source. The winds in the vicinity of the Site have been characterised using a three-dimensional meteorological model called CALMET. The 1-hour average wind speed for the modelling period is 4.33 m/s. This compares to a 1-hour average wind speed of 3.0 m/s at Moore Park between 2011 and 2018 and 4.3 m/s at Gurteen between 2008 and 2018 (EPA, 2020). A wind rose representing the annual distribution of 1-hour average winds is presented in Figure 5.

The prevailing wind direction in Ireland is between south and west. It is clear from Figure 5 that these winds influence wind patterns at the Site; however, due to the elevated terrain the modelling indicates that the south-westerly winds are channelled in a predominant southerly direction at the Site. Daytime winds between 6 am and 6 pm are heavily influenced by the prevailing winds and channelling due to local terrain. During late evening and early morning, prevailing winds also dominate; however, there is also a substantial proportion of winds from the northwest as indicated in the diurnal wind roses (Figure 6).

The seasonal distribution of wind speed and wind direction is presented in Figure 7. The strongest winds at the Site occur most frequently from the south during the winter months. The greatest proportion of light winds occur during summer. There is a distinct north-westerly component to the wind rose in all seasons. A significant proportion of light north westerly winds occur during spring months.

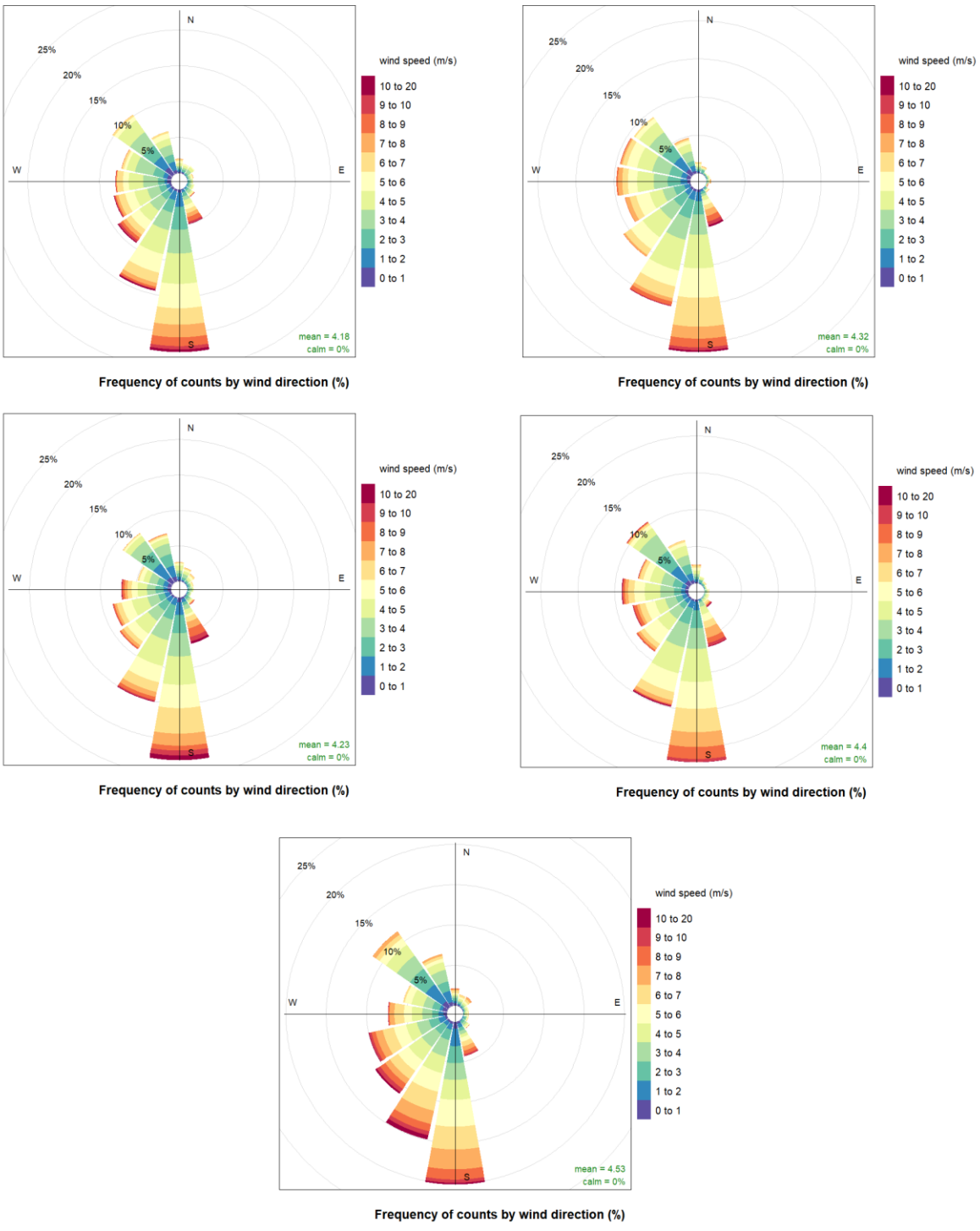

Figure 5 **Annual wind distribution predicted at the Site using CALMET for 2016 (top-left), 2017 (top-right), 2018 (mid-left), 2019 (mid-right) and 2020 (bottom)**

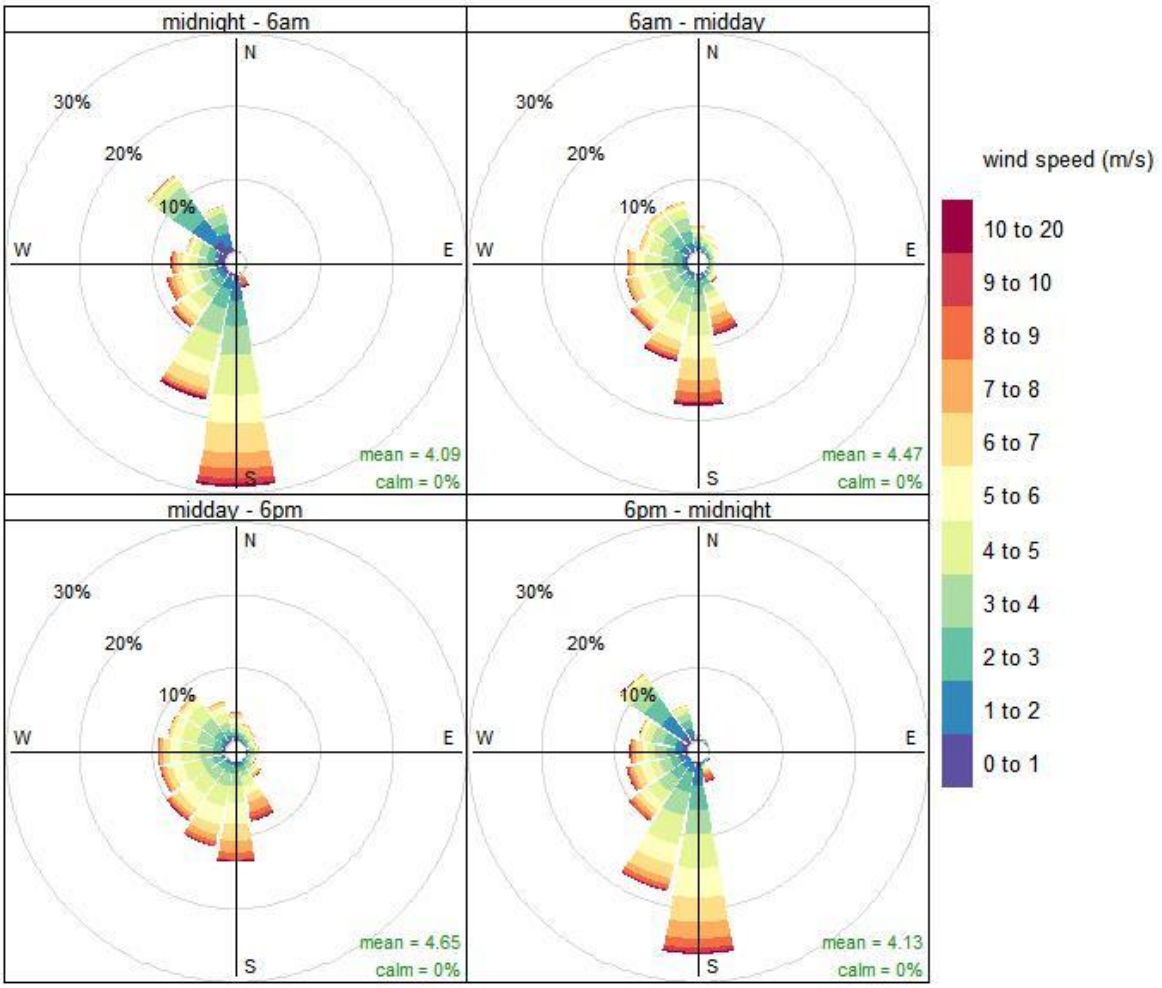

Figure 6 Diurnal wind distribution predicted at the Site using CALMET

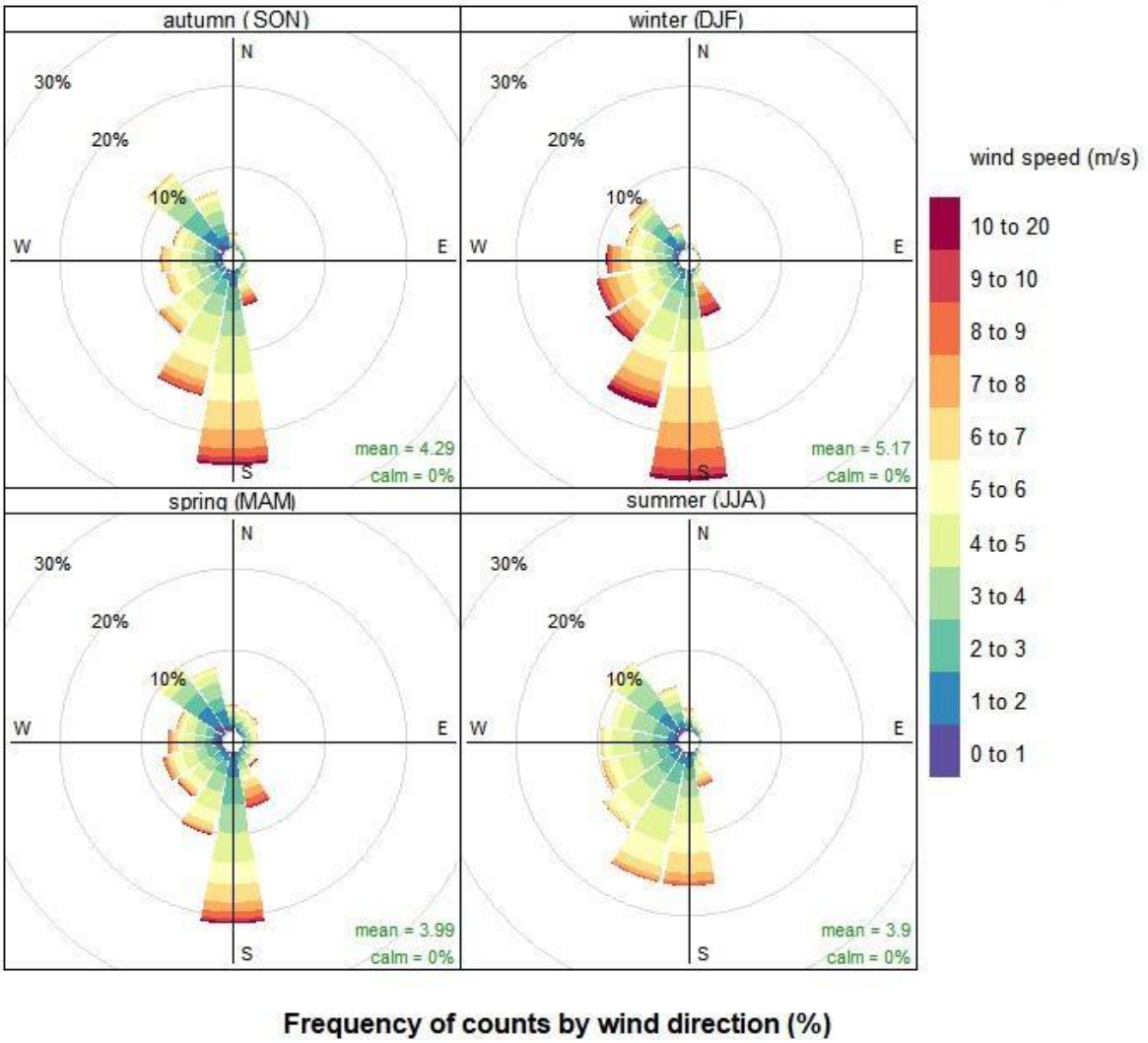

Figure 7 Seasonal wind distribution predicted at the Site using CALMET

4.3 Sensitive receptors

The sensitive receptors that are nearest to the Site are presented in Figure 8. The closest sensitive receptor is 43 m west of the Site boundary and 60 m west of the closest pig housing unit at the Site. Other sensitive receptors are located further away to the north, northeast, east, southeast and south were included in the modelling assessment.

There are two properties located in close proximity to the pig farm, immediately north and south of the Site boundary that are not sensitive receptors. These properties owned by Ballyfaskin Enterprises (owner and father of owner of Ballyfaskin Enterprises).

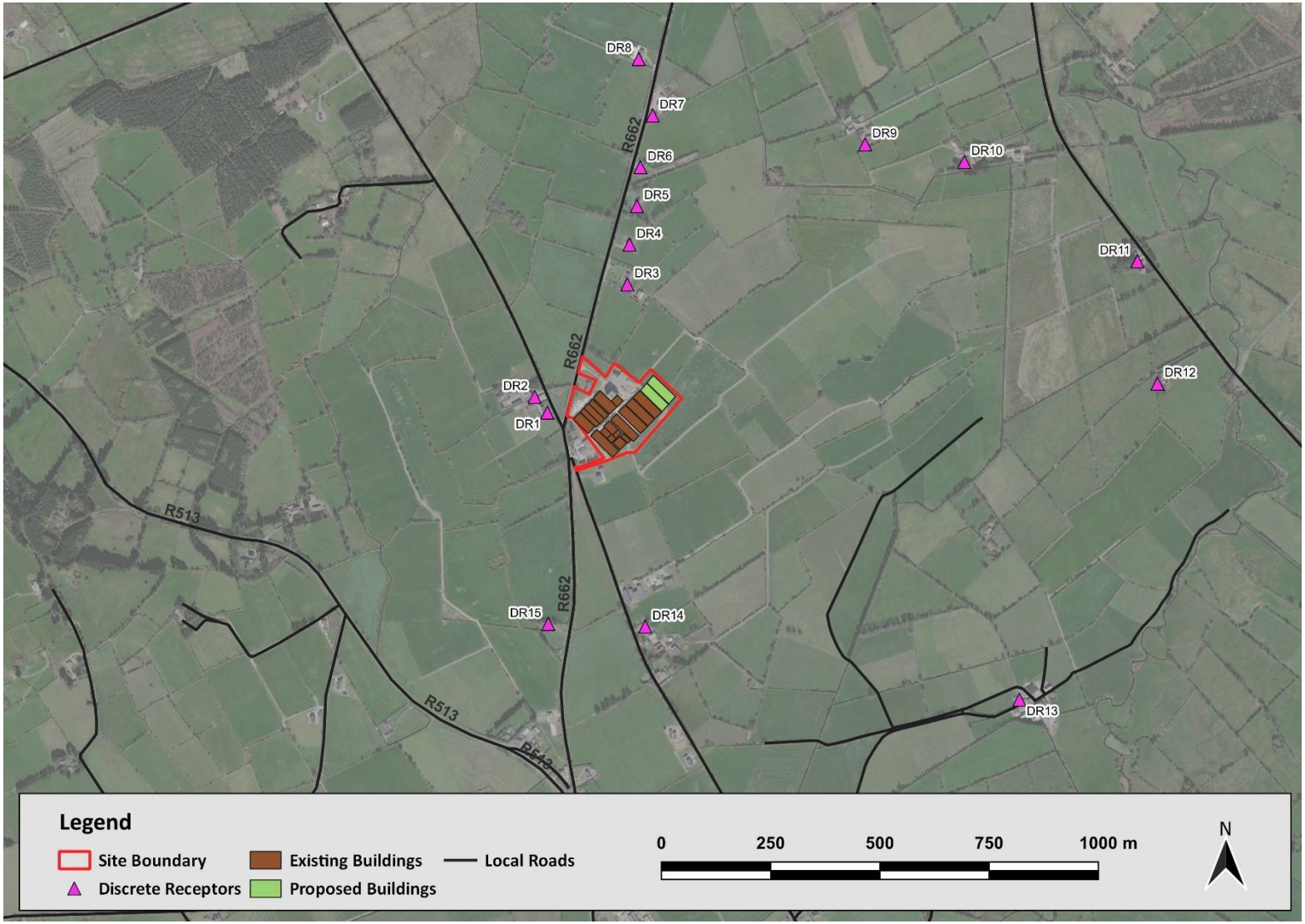

Figure 8 **Nearest sensitive odour receptors to the pig farm**

5. ODOUR IMAPCT ASSESSMENT

5.1 Methodology

The following section describes the modelling methodology that was adopted to assess the potential impacts of odour from the pig farm. The methodology is based on a dispersion modelling study incorporating source characteristics and operational activity data with meteorological data that is representative of the Site and surrounding region. The assessment has been prepared in accordance with industry standards, regulatory requirements and best practice approaches.

The assessment methodology has included:

- Selection of odour assessment criteria from Irish guidance.
- Derivation of an emissions inventory for the pig farm based on:
    - The layout and design of the housing units and sources
    - Emission factors from the EPA 2022 Pig Instruction Note.
- Generation of a representative meteorological dataset using prognostic meteorological modelling techniques.
- Characterisation of meteorological conditions in the region using prognostic meteorological data
- Dispersion modelling using the regulatory dispersion model, CALPUFF, to predict ground-level concentrations of odour across a Cartesian grid that covers the study area.
- Comparison of the predicted ground-level concentrations of odour against the odour assessment criteria.

5.2 Meteorological modelling

5.2.1 Overview

EPA's Air Dispersion Modelling Guidance Note (AG4) states that the dispersion process is dependent on the underlying meteorological conditions and ensuring that the air dispersion model includes representative meteorological data is critical. In the absence of Site-specific meteorological data, AG4 requires the use of representative data observed at a Met Eireann monitoring location. AG4 states:

> *The USEPA (24) has defined meteorological representativeness as:*
>
> > *"the extent to which a set of {meteorological} measurements taken in a space-time domain reflects the actual conditions in the same or different space-time domain taken on a scale appropriate for a specific application"*
>
> *and has expanded on this definition by outlining the factors to consider in the selection of appropriate meteorological data:*
>
> - *Proximity of the meteorological station to the modelling domain;*
> - *The complexity of the terrain;*
> - *The exposure of the meteorological monitoring Site;*
> - *The period of time during which data is collected."*

The modelling domain includes areas of complex terrain. The meteorological parameters that affect dispersion are likely to vary spatially and temporally across the modelling domain due to the complexity of the terrain.

The closest Met Eireann monitoring location to the Site is at Moore Park, Co. Cork which is 22 km south of the pig farm. This monitoring station is in rural rolling landscape. It sits at a low point in the local terrain and is close to the Blackwater River. Meteorological data at Moore Park is characterised by frequent easterly and westerly winds that occur due to the east-west orientation of the valley in which the monitoring station is located. The meteorological station at Moore Park is not likely to be representative of meteorological conditions at the Site as the terrain at both locations is very different.

A review by Katestone indicates that there are no other meteorological observation stations on the Met Eireann Network that meet the requirements specified in AG4 to be considered representative of the modelling domain.

Where Site specific or representative meteorological data is not available, AG4 provides the following alternatives:

> *Prognostic meteorological data should be considered in locations where there is no comparable representative Met Eireann station particularly in areas of complex terrain or at a land / sea interface.*

and

> *Prognostic meteorological data may be useful in locations where there is no comparable representative Met Eireann station. Locations where prognostic meteorological data may be required include regions of complex terrain and at a land/sea interface in circumstances where the nearest meteorological stations are outside of the modelling domain. As outlined by the USEPA, meteorological data should be spatially representative of the modelling domain and in particular of the pathway from the source to the most impacted receptor.*

Accordingly, prognostic meteorological data was generated for the Site due to the complexity of the terrain. The approach adopted to generate representative Site-specific data utilised a numerical model to generate a 3-dimensional grid of spatially varying meteorological parameters to represent conditions surrounding the Site. The approach is described in Appendix A1.

5.2.2 Meteorology

The prognostic model TAPM (developed in Australia by the Commonwealth Scientific and Industrial Research Organisation [CSIRO], version 4.0.5) and the diagnostic meteorological model CALMET (developed by EarthTec, version 6.5) were used to generate the three-dimensional meteorological dataset for the region.

The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the innermost nest. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

The three-dimensional wind field produced by TAPM/CALMET was then used to create a meteorological file suitable for us with the CALPUFF dispersion model.

Details of the model configuration and evaluation are presented in Appendix A.

The TAPM/CALMET approach has been used in jurisdictions like Australia to generate suitable meteorological data for modelling odour impacts for over 15 years. It has been adopted in for the assessment of a number proposed projects in Ireland in the last 5 years. There is significant experience using these approaches in jurisdictions such as Australia. Industry specific guidance on modelling odour dispersion from sources such as intensive poultry farms and cattle feedlots recommend the use of TAPM/CALMET to generate representative Site-specific data. Research in Europe indicates that meteorological data generated using a numerical model provided a better indication of locations where odour nuisance occurred (Feliubadaló et al, 2008). In that study, locations of likely odour nuisance

were determined using the German VDI grid assessment approach. The correlation between observed and modelled odour concentrations was significantly better using the TAPM/CALMET approach compared to traditional steady state gaussian models such as AERMOD.

5.3 Emissions

5.4 Overview

The derivation of an odour emissions inventory for the Site is presented in this section.

There is no emissions monitoring data available for the pig farm. Odour emission rates from the pig housing units at pig farms vary considerably depending on factors such as:

- The ventilation rate which is heavily influenced by:
    - The target temperature of the pigs in the unit which is influenced by:
        - Type of pig (sow, weaner, finisher)
        - The age of the pigs.
    - The ambient temperature outside the pig unit.
- The design of the housing system including but not limited to the following:
    - Depth of manure holding pits
    - Frequency on manure removal
    - Ventilation design
    - Surface area of manure exposed beneath the slats.
- The depth of manure in the house which varies considerably with season.

The odour emission rates for the pig farm were derived from EPA recommended emission factors published in the EPA 2022 Pig Instruction Note. Whilst a site-specific odour emissions inventory could be developed by sampling the subject Site, it would require a significant amount of sampling to be conducted over different seasons and farm operating conditions, which is not economically viable.

5.4.1 Odour Emission Rates

The EPA 2022 Pig Instruction Note presents recommended approaches for the assessment of odour impact from pig farms in Ireland using:

- A screening tool approach (Screening Approach)
- A detailed modelling for odour assessment approach (detailed modelling approach).

The screening tool approach defined in the EPA 2022 Pig Instruction Note mandates the use of screening odour emission rates to determine if a pig farm is compliant with the relevant odour impact criterion.

The detailed modelling approach described in the EPA 2022 Pig Instruction Note presents lower emission factors that may be used in a detailed modelling assessment. Lower emission factors may be used when applicable emission reduction techniques are adopted on a pig farm.

The odour emission rates adopted in this assessment are based on screening odour emission rates presented in EPA 2022 Pig Instruction Note, which are reproduced in Table 1 below.

5.4.1.1 Screening odour emission rates

The EPA 2022 Pig Instruction Note requires the calculation of a baseline odour emission rate by pig type based on the odour emission rates presented in Table 1.

Table 1 Odour emission factors for the different pig types used in the screening tool described in the EPA 2022 Pig Instruction Note

Type of Pig	Recommended odour emission Factor
	OU_E/s/pig
Dry Sow	21.0
Farrowing Sows	20.0
Weaners	6.0
Growers	12.0
Finishers	20.0
Fatteners[1]	17.3
Maiden Gilts	20.0

[1] In this document fatteners refer to the combined number of growers and finishers, which are defined in the EPA 2022 Pig Instruction Note. Growers and finisher are reared in the same housing units on pig farms. The emission rates for growers and finishers are therefore modelled using a single emission factor, presented for fatteners, which is calculated as a weighted average odour emission rate based on the proportion of growers/finishers on a pig farm and the odour emission rate specified in the EPA 2022 Pig Instruction Note for each category of pig

The typical pig weights by animal category are defined in the EPA 2022 Pig Instruction Note as:

- Between 8 kg and 30 kg for weaners
- Between 30 kg and 60 kg for growers
- Between 60 kg and 120 kg for finishers.

The typical pig weights by animal category defined in the EPA 2022 Pig Instruction Note indicate that in relation to pigs between 30 kg and 120 kg:

- 33.3% are growers weighing between 30 kg and 60 kg for
- 66.6% are finishers weighing between 60 kg and 120 kg.

Pig farms in Ireland generally separate pigs in dedicated houses for weaners (8 kg and 30 kg) and pigs above 30 kg classified as fatteners (which includes growers and finishers).

Considering that growers and finishers are housed in the same housing units at the subject pig farm, a weighted average odour emission rate has been determined for fatteners based on:

- The odour emission rates for growers and finishers defined in the EPA 2022 Pig Instruction Note
- The proportion of fatteners made up of growers and finishers as per the EPA 2022 Pig Instruction Note.

A screening odour emission rate of 17.33 ou_E/s/pig has been determined for fatteners at the pig farm.

5.4.1.2 Detailed dispersion modelling odour emission rate

On 15 February 2017, the European Commission adopted Commission Implementing Decision (EU) 2017/302 (2017 CID). The 2017 CID establishes 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. The 2017 CID and its associated BAT Reference document (BREF document) include the theory behind the sources of odour and possible odour control techniques available for the intensive agriculture (poultry and pigs) sector.

The EPA 2022 Pig Instruction Note states

> *The 2017 CID and BREF note include techniques to reduce emissions of odour (BAT 13) from the whole farm and to reduce ammonia (BAT 30) from animal housing. Whilst BAT 30 is specific to reducing ammonia emissions, the BREF outlines how odour emissions can also be reduced by implementing various BAT 30 techniques*
>
> *The BREF note describes how emissions associated with standard housing with a deep pit can be reduced for existing animal housing through their use in combination with other techniques (e.g., nutritional management, an air cleaning system, pH reduction of slurry, or slurry cooling).*

Further detail of pig housing types and housing systems to reduce emissions of odour are presented in the EPA 2022 Pig Instruction Note (EPA, 2022).

The EPA 2022 Pig Instruction Note presents recommended levels of mitigation (odour emission reduction factors) that can be applied to the screening odour emission rates presented for the screening approach.

The odour emission mitigation measures that will be employed at the pig farm include:

- Manipulation of dietary protein and supplements
- The use of reduced manure volume pit.

In relation to the Manipulation of dietary protein and supplements, the EPA 2022 Pig Instruction Note states

> *Manipulating animal feed by reducing dietary protein will reduce the amount of unused protein that passes through a pig's digestive system. Fewer precursor compounds present in the slurry will reduce potential odour.*
>
> *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.*

Ballyfaskin Enterprises has worked with animal nutritionists to reduce crude protein and supplements in the pigs diet. The levels of crude protein and supplements has been optimised at levels that minimise the amount of unused protein that passes through the pig's digestive system. This approach has reduced dietary crude protein by levels that surpass 3%. A reduction of 30%, which is the maximum reduction factor that can be applied as specified in the EPA 2022 Pig Instruction Note, has, therefore, been applied to the emission factors for all pig types at the pig farm as part of the detailed modelling assessment.

In relation to the use of a reduced manure volume pit, the depth of manure in the proposed new pig housing units at the Site will be maintained at a level of 60 cm or less. Manure will be removed frequently to external covered storage that will be constructed as part of the proposed development.

The use of a reduced manure volume pit and frequent slurry removal results in an odour emission reduction efficiency of 25% as specified in the EPA 2022 Pig Instruction Note.

The EPA 2022 Pig Instruction Note has a comprehensive section on odour mitigation offered when multiple odour mitigation techniques are adopted and states:

> *The main focus of odour mitigation used to abate odour from a pig rearing activity seeks to either prevent the amount of precursor compounds present which will degrade or to manipulate the anaerobic environment to avoid any precursors degrading, and odorous compounds being released. It can therefore be seen that when dietary manipulation is used in conjunction with a system integrated housing technique, there would be a degree of 'double counting' if the applicant were to add the individual reductions set out above.*

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.*

The odour emission rates adopted for the existing housing units at the pig farm were determined as the screening odour emission factors specified in the EPA 2022 Pig Instruction Note reduced by 30% to account for dietary manipulation, which will be adopted by Ballyfaskin Enterprises

The odour emission rates adopted for the proposed housing units at the pig farm were determined as the screening odour emission factors specified in the EPA 2022 Pig Instruction Note reduced by 42.5% to account for:

- Dietary manipulation adopted by Ballyfaskin Enterprises which reduces emissions by 30%
- Reduced manure volume pit which reduces emission by 25%; however, based on the requirements of adopting multiple odour mitigation techniques, the EPA 2022 Pig Instruction Note mandates that half of this abatement efficiency (12.5%) can be included in the calculation of reduced odour emission factors in a detailed dispersion modelling assessment.

The odour emission rates adopted in the detailed dispersion modelling assessment for the existing housing units are presented in Table 2.

The odour emission rate adopted in the detailed dispersion modelling assessment for the proposed housing units, which will only house grower and finisher pigs is presented in Table 3.

Table 2 The odour emission rates adopted for each category of pig in the existing housing units at the pig farm

Type of Pig	Recommended odour emission Factor
	OU_E/s/pig
Dry Sow	14.7
Farrowing Sows	14.0
Weaners	4.2
Growers	8.4
Finishers	14.0
Fatteners[1]	12.1
Maiden Gilts	14.0

[1] In this document fatteners refer to the combined number of growers and finishers, which are defined in the EPA 2022 Pig Instruction Note. Growers and finisher are reared in the same housing units on pig farms. The emission rates for growers and finishers are therefore modelled using a single emission factor, presented for fatteners, which is calculated as a weighted average odour emission rate based on the proportion of growers/finishers on a pig farm and the odour emission rate specified in the EPA 2022 Pig Instruction Note for each category of pig

Table 3 The odour emission rates adopted for each category of pig in the existing housing units at the pig farm

Type of Pig	Recommended odour emission Factor
	OU_E/s/pig
Growers	6.9
Finishers	11.5
Fatteners[1]	10.0

[1] In this document fatteners refer to the combined number of growers and finishers, which are defined in the EPA 2022 Pig Instruction Note. Growers and finisher are reared in the same housing units on pig farms. The emission rates for growers and finishers are therefore modelled using a single emission factor, presented for fatteners, which is calculated as a

weighted average odour emission rate based on the proportion of growers/finishers on a pig farm and the odour emission rate specified in the EPA 2022 Pig Instruction Note for each category of pig

5.5 Dispersion modelling

The assessment was conducted in accordance with recognised techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). CALPUFF was used to predict ground-level concentrations of odour across the modelling domain and at sensitive receptor locations due to sources at the pig farm.

The details of source characterisation utilised for the pig farm in the modelling assessment are provided in Section 5.8.

5.6 Building downwash

When modelling emissions from an industrial installation it should be borne in mind that stacks which are relatively short can be subjected to additional turbulence due to the presence of nearby buildings. Buildings are considered nearby if they are within five times the lesser of the building height or maximum projected building width (but not greater than 800m) (EPA, 2020).

A plume of a short stack is likely to be downwashed if its height is less than two and a half times the height of nearby buildings within a distance of 10 x L from each source, where L is the lesser of the height or width of the building. A Building Profile Input Program (BPIP) was used to determine the effects of buildings at the Site on the point sources of emissions at the pig farm. The Plume Rise Model Enhancements (PRIME) algorithm is recommended in EPA Guidance for use with AERMOD. PRIME was used in the dispersion modelling assessment to determine the effect of building induced turbulence on plumes from point sources at the pig farm.

The PRIME algorithm takes into account the position of each stack relative to each relevant building and the projected shape of each building for 36 wind directions (at 10º intervals). The model determines the change in plume centreline location with downwind distance based on the slope of the mean streamlines and coupled to a numerical plume rise model.

There were 20 onsite buildings/structures included in the BPIP program to represent pig housing units and other onsite buildings.. The coordinates used in the configuration of the pig housing units and onsite buildings in the PRIME BPIP model for this assessment are presented in Table 4.

Table 4 Pig housing units included and configuration of the pig housing units in BPIP

Building	Easting	Northing	Height (m)
	UTM (m)	UTM (m)	
B1	547184.3	5801543	5.2
	547133.6	5801592	
	547149.9	5801607	
	547199.7	5801558	
B2	547167.8	5801526	5.2
	547117	5801575	
	547132.9	5801590	
	547183.3	5801542	
B3	547151.5	5801509	5.2
	547100	5801559	
	547116.1	5801574	
	547167.4	5801525	
B4	547134.8	5801491	7.2
	547082.8	5801540	
	547096.5	5801554	
	547147.7	5801505	
B5	547087.3	5801505	4.5
	547066.7	5801526	
	547079.2	5801538	
	547100.1	5801518	
B6	547095.3	5801498	4.5
	547087.2	5801505	
	547100	5801518	
	547107.8	5801511	
B7	547122.2	5801487	4.0
	547105.8	5801502	
	547112.3	5801509	
	547129.1	5801494	
B8	547104.3	5801472	4.0
	547088.3	5801488	
	547103.5	5801503	
	547119.6	5801488	
B9	547074.8	5801498	4.0
	547058.8	5801513	
	547069	5801523	
	547084.8	5801508	
B10	547085	5801488	4.0
	547074.8	5801498	
	547084.7	5801508	

Building	Easting	Northing	Height (m)
	UTM (m)	UTM (m)	
	547095.1	5801498	
B11	547087	5801455	7.0
	547037.2	5801504	
	547051.6	5801518	
	547102.1	5801470	
B13	547031.3	5801509	6.0
	546997.3	5801542	
	547012.6	5801558	
	547046.6	5801526	
B14	547049.3	5801524	3.4
	547013.2	5801558	
	547021.4	5801567	
	547057.3	5801532	
B15	547058.5	5801531	4.0
	547021.4	5801567	
	547032.1	5801578	
	547069.2	5801543	
B16	547069.2	5801542	4.0
	547032.3	5801578	
	547041.1	5801587	
	547078.4	5801552	
B17	547080.9	5801554	7.0
	547042.9	5801590	
	547058.6	5801607	
	547097.2	5801570	
B18	547097.9	5801570	18.3
	547084.5	5801583	
	547097.8	5801597	
	547111.4	5801584	
B19	547216.2	5801577	5.2
	547165.7	5801625	
	547180.4	5801642	
	547231.2	5801594	
B20	547200.6	5801559	5.2
	547150.9	5801608	
	547165.4	5801625	
	547215.4	5801576	

5.7 Sources of Emissions

The pig housing units included in the dispersion modelling assessment are presented in Table 5, which specifies:

- The housing unit at the pig farm (existing and proposed)
- The type of pigs housed (proposed development as modelled)
- The type of ventilation (proposed development as modelled)
- The number of pigs housed in the building (proposed development as modelled)
- The number of sources used to represent the mechanical ventilation points in the modelling assessment.

All pig housing units at the Site will be mechanically ventilated sheds and were configured as point sources in the modelling assessment.

The sources included in the modelling assessment, the number of pigs per source and the odour emission rate per source included in the modeling assessment are presented in Table 6.

Table 5 Pig housing units included in the dispersion modelling assessment

Housing Unit	Type of Pig	Type of Ventilation	Number of Housed Pigs	Number of modelled sources
B1	Fattener	Mechanical	1296	2
B2	Fattener	Mechanical	1296	2
B3	Dry Sow	Mechanical	430	2
B4	Dry Sow	Mechanical	450	10
B5	Weaner	Mechanical	660	4
B6	Weaner	Mechanical	660	2
B7	Weaner	Mechanical	240	1
B8	Fattener	Mechanical	300	4
B9	Weaner	Mechanical	800	3
B10	Weaner	Mechanical	800	3
B11	Fattener	Mechanical	1000	14
B13	Weaner	Mechanical	2200	10
B14	Farrowing	Mechanical	46	8
B15	Farrowing	Mechanical	96	4
B16	Farrowing	Mechanical	96	4
B17	Dry Sow	Mechanical	350	4
B19a	Fattener	Mechanical	648	1
B19b	Fattener	Mechanical	648	1
B20	Fattener	Mechanical	1296	2

Table 6 Sources and odour emission rate of sources included in the modelling assessment

Housing Unit	Source Number	Number of pigs per source	Odour Emission rate (ou/s)
B4	B4_1	45	661.5
	B4_2	45	661.5
	B4_3	45	661.5
	B4_4	45	661.5
	B4_5	45	661.5
	B4_6	45	661.5
	B4_7	45	661.5
	B4_8	45	661.5
	B4_9	45	661.5
	B4_10	45	661.5
B5	B5_1	165	693.0
	B5_2	165	693.0
	B5_3	165	693.0
	B5_4	165	693.0
B6	B6_1	330	1386.0
	B6_2	330	1386.0
B8	B8_1	75	910.0
	B8_2	75	910.0

Housing Unit	Source Number	Number of pigs per source	Odour Emission rate (ou/s)
	B8_3	75	910.0
	B8_4	75	910.0
B9	B9_1	267	1120.0
	B9_2	267	1120.0
	B9_3	267	1120.0
B10	B10_1	267	1120.0
	B10_2	267	1120.0
	B10_3	267	1120.0
B11	B11_1	71	866.7
	B11_2	71	866.7
	B11_3	71	866.7
	B11_4	71	866.7
	B11_5	71	866.7
	B11_6	71	866.7
	B11_7	71	866.7
	B11_8	71	866.7
	B11_9	71	866.7
	B11_10	71	866.7
	B11_11	71	866.7
	B11_12	71	866.7
	B11_13	71	866.7
	B11_14	71	866.7
B13	B13_1	220	924.0
	B13_2	220	924.0
	B13_3	220	924.0
	B13_4	220	924.0
	B13_5	220	924.0
	B13_6	220	924.0
	B13_7	220	924.0
	B13_8	220	924.0
	B13_9	220	924.0
	B13_10	220	924.0
B14	B14_1	6	80.5
	B14_2	6	80.5
	B14_3	6	80.5
	B14_4	6	80.5
	B14_5	6	80.5
	B14_6	6	80.5
	B14_7	6	80.5
	B14_8	6	80.5
B15	B15_1	24	336.0

Housing Unit	Source Number	Number of pigs per source	Odour Emission rate (ou/s)
	B15_2	24	336.0
	B15_3	24	336.0
	B15_4	24	336.0
B16	B16_1	24	336.0
	B16_2	24	336.0
	B16_3	24	336.0
	B16_4	24	336.0
B17	B17_1	88	1286.3
	B17_2	88	1286.3
	B17_3	88	1286.3
	B17_4	88	1286.3
B1	B1_T1	648	7862.4
	B1_T2	648	7862.4
B2	B2_T3	648	7862.4
	B2_T4	648	7862.4
B3	B3_T5	215	3160.5
	B3_T6	215	3160.5
B7	B7_1	240	1008.0
B19a	B19_T1	648	6458.4
B19b	B19_T2	648	6458.4
B20	B20_T1	648	6458.4
	B20_T2	648	6458.4

5.8 Source configuration

The pig housing units at the pig farm are all mechanically ventilated and were, therefore, modelled as point sources in the modelling assessment. This section describes the configuration of the point sources included in the CALPUFF modelling assessment.

Table 7 lists the point sources included in the modelling assessment and relevant modelling parameters including:

- The source coordinates
- The base elevations
- Stack height
- Stack diameter
- Exhaust temperature
- Exhaust velocity.

The building locations, configuration and heights were determined from Site plans provided by Ballyfaskin Enterprises, correspondence between Katestone and Ballyfaskin Enterprises and from satellite imagery.

Table 7 Source parameters for the point sources at the pig farm

Source Number	x-coordinate	y-coordinate	Base Elevation	Stack Height	Diameter	Temperature	Velocity
	km	km	m	m	m	°C	m/s
B4_1	547.140	5801.499	167.3	5.65	0.61	20	6.8
B4_2	547.138	5801.501	167.3	5.65	0.61	20	6.8
B4_3	547.136	5801.503	167.4	5.65	0.61	20	6.8
B4_4	547.134	5801.505	167.4	5.65	0.61	20	6.8
B4_5	547.130	5801.508	167.6	5.65	0.61	20	6.8
B4_6	547.128	5801.51	167.6	5.65	0.61	20	6.8
B4_7	547.126	5801.512	167.7	5.65	0.61	20	6.8
B4_8	547.124	5801.514	167.7	5.65	0.61	20	6.8
B4_9	547.119	5801.52	167.9	5.65	0.61	20	6.8
B4_10	547.112	5801.526	168.1	5.65	0.61	20	6.8
B5_1	547.080	5801.535	169.3	4.97	0.61	21	6.8
B5_2	547.086	5801.53	169.1	4.97	0.61	21	6.8
B5_3	547.092	5801.525	168.9	4.97	0.61	21	6.8
B5_4	547.097	5801.52	168.7	4.97	0.61	21	6.8
B6_1	547.102	5801.515	168.5	4.97	0.61	21	6.8
B6_2	547.107	5801.51	168.4	4.97	0.61	21	6.8
B8_1	547.105	5801.489	168.6	4.50	0.61	20	6.8
B8_2	547.104	5801.487	168.7	4.50	0.61	20	6.8
B8_3	547.106	5801.485	168.6	4.50	0.61	20	6.8
B8_4	547.107	5801.487	168.6	4.50	0.61	20	6.8
B9_1	547.066	5801.517	170.2	4.48	0.61	25	6.8
B9_2	547.070	5801.514	170.1	4.48	0.61	25	6.8
B9_3	547.075	5801.51	169.9	4.48	0.61	25	6.8
B10_1	547.080	5801.505	169.7	4.48	0.61	25	6.8
B10_2	547.084	5801.501	169.5	4.48	0.61	25	6.8
B10_3	547.089	5801.497	169.2	4.48	0.61	25	6.8
B11_1	547.088	5801.468	169.6	7.45	0.61	20	6.8
B11_2	547.090	5801.47	169.4	7.45	0.61	20	6.8
B11_3	547.086	5801.47	169.7	7.45	0.61	20	6.8
B11_4	547.088	5801.471	169.5	7.45	0.61	20	6.8
B11_5	547.071	5801.485	170.4	7.45	0.61	20	6.8
B11_6	547.069	5801.486	170.5	7.45	0.61	20	6.8
B11_7	547.071	5801.488	170.3	7.45	0.61	20	6.8
B11_8	547.073	5801.486	170.3	7.45	0.61	20	6.8
B11_9	547.058	5801.497	170.9	7.45	0.61	20	6.8
B11_10	547.059	5801.498	170.9	7.45	0.61	20	6.8
B11_11	547.054	5801.502	171.1	7.45	0.61	20	6.8
B11_12	547.055	5801.503	171.0	7.45	0.61	20	6.8

Source Number	x-coordinate	y-coordinate	Base Elevation	Stack Height	Diameter	Temperature	Velocity
	km	km	m	m	m	°C	m/s
B11_13	547.050	5801.505	171.2	7.45	0.61	20	6.8
B11_14	547.051	5801.506	171.2	7.45	0.61	20	6.8
B13_1	547.037	5801.518	171.7	5.55	0.61	21	6.8
B13_2	547.035	5801.52	171.7	5.55	0.61	21	6.8
B13_3	547.030	5801.524	171.9	5.55	0.61	21	6.8
B13_4	547.028	5801.527	171.9	5.55	0.61	21	6.8
B13_5	547.023	5801.532	172.0	5.55	0.61	21	6.8
B13_6	547.021	5801.534	172.1	5.55	0.61	21	6.8
B13_7	547.018	5801.536	172.2	5.55	0.61	21	6.8
B13_8	547.013	5801.541	172.3	5.55	0.61	21	6.8
B13_9	547.010	5801.544	172.3	5.55	0.61	21	6.8
B13_10	547.008	5801.546	172.4	5.55	0.61	21	6.8
B14_1	547.048	5801.526	171.0	3.92	0.45	22	5.6
B14_2	547.043	5801.531	171.1	3.92	0.45	22	5.6
B14_3	547.038	5801.535	171.3	3.92	0.45	22	5.6
B14_4	547.033	5801.54	171.4	3.92	0.45	22	5.6
B14_5	547.029	5801.544	171.5	3.92	0.45	22	5.6
B14_6	547.025	5801.548	171.6	3.92	0.45	22	5.6
B14_7	547.021	5801.552	171.7	3.92	0.45	22	5.6
B14_8	547.016	5801.557	171.7	3.92	0.45	22	5.6
B15_1	547.063	5801.544	170.0	4.55	0.61	22	6.8
B15_2	547.053	5801.553	170.3	4.55	0.61	22	6.8
B15_3	547.044	5801.562	170.5	4.55	0.61	22	6.8
B15_4	547.034	5801.571	170.7	4.55	0.61	22	6.8
B16_1	547.072	5801.554	169.5	4.55	0.61	22	6.8
B16_2	547.063	5801.563	169.7	4.55	0.61	22	6.8
B16_3	547.054	5801.572	169.9	4.55	0.61	22	6.8
B16_4	547.044	5801.581	170.2	4.55	0.61	22	6.8
B17_1	547.085	5801.566	168.8	7.45	0.61	20	6.8
B17_2	547.075	5801.575	169.1	7.45	0.61	20	6.8
B17_3	547.066	5801.584	169.3	7.45	0.61	20	6.8
B17_4	547.056	5801.592	169.6	7.45	0.61	20	6.8
B1_T1	547.196	5801.554	164.7	10.00	1.75	20	7.2
B1_T2	547.188	5801.546	165.1	10.00	1.75	20	7.2
B2_T3	547.180	5801.537	165.5	10.00	1.75	20	7.2
B2_T4	547.171	5801.529	165.9	10.00	1.75	20	7.2
B3_T5	547.163	5801.521	166.2	10.00	1.75	20	7.2
B3_T6	547.155	5801.512	166.6	10.00	1.75	20	7.2
B7_1	547.117	5801.498	168.1	6.00	1.75	21	7.2
B19_1	547.228	5801.588	163.5	10.00	1.75	20	7.2

Source Number	x-coordinate	y-coordinate	Base Elevation	Stack Height	Diameter	Temperature	Velocity
	km	km	m	m	m	°C	m/s
B19_2	547.220	5801.579	163.8	10.00	1.75	20	7.2
B20_1	547.211	5801.569	164.1	10.00	1.75	20	7.2

6. ASSESSMENT RESULTS

Dispersion modelling has been conducted for five years of meteorological data. The following sections present the highest concentrations across the five-year modelled period.

Predicted ground-level concentrations of odour (1-hour average, 98th percentile) at the nearest sensitive receptors due to the pig farm are presented in Table 8. Plate 1 is a contour plot that presents the highest ground-level concentrations (1-hour average, 98th percentile) across the model domain during the five-year period.

The results show that predicted concentrations **comply** with the odour criterion recommended by EPA for new pig farms of 5.0ou$_E$/m^3 at all sensitive receptors included in the modelling assessment.

Table 8 Predicted ground-level concentrations of odour (1-hour average, 98th percentile) at the nearest sensitive receptors due to the pig farm

Receptor	1-hour 98th Odour Concentrations (ou$_E$/m^3)					
	2015	2016	2017	2018	2019	Maximum 5-year
DR1	4.1	1.4	3.8	2.4	3.6	4.1
DR2	2.8	0.9	2.5	1.4	2.5	2.8
DR3	4.5	4.6	4.8	4.8	4.2	4.8
DR4	3.6	3.6	3.8	3.9	3.0	3.9
DR5	2.7	2.9	2.7	3.0	2.2	3.0
DR6	1.6	1.8	1.7	1.8	1.4	1.8
DR7	1.2	1.3	1.3	1.4	1.1	1.4
DR9	1.2	1.3	1.2	1.0	1.1	1.3
DR10	0.7	0.9	0.8	0.8	0.8	0.9
DR11	0.5	0.6	0.6	0.5	0.5	0.6
DR12	0.5	0.7	0.5	0.6	0.4	0.7
DR13	1.1	1.0	0.6	0.9	0.8	1.1
DR14	1.2	0.7	1.3	1.2	1.3	1.3
DR15	0.9	0.4	1.1	0.6	0.8	1.1
Odour Criteria	**5.0 ou$_E$/m^3**					

7. CONCLUSIONS

Ballyfaskin Enterprises commissioned Katestone to complete an odour impact assessment (OIA) for a pig farm located at Ballylanders, County Limerick, V35 KV12 (Site).

Ballyfaskin Enterprises proposes to:

- Increase pig numbers with the addition of four (4) rows of new housing units immediately northeast of the existing housing units at the Site.
- Reconfigure the exhausts of naturally ventilated sheds at the Site with mechanically ventilated chimney stacks to reduce the impact of emissions exhausted to the atmosphere.

The assessment is required to determine the potential impact of odorous emissions from the proposed development at the pig farm on nearby residential locations. The assessment will be submitted as part of planning and licensing applications for the pig farm.

The odour assessment was conducted in accordance with recognised techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). The dispersion model, CALPUFF, was used to predict ground-level concentrations of odour across the model domain due to the pig farm. The assessment of odour has also been conducted in accordance with EPA's instruction note for the assessment of odour emissions from intensive agriculture pig installations (EPA, 2022).

The odour modelling assessment found that the predicted concentrations of odour at all sensitive receptors **comply** with odour criterion recommended by EPA for existing pig farms of $5.0ou_E/m^3$ at all modelled sensitive receptor locations.

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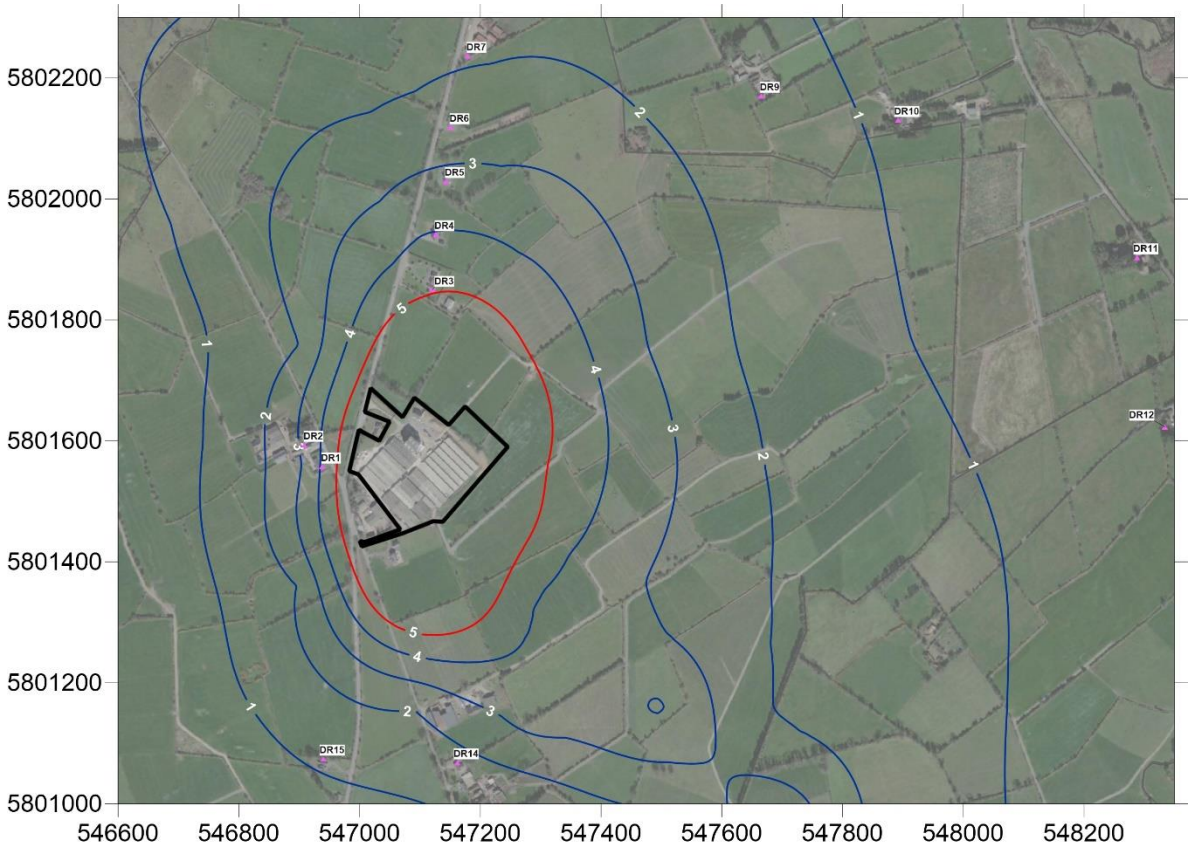

Plate 1 **Highest predicted 98th percentile 1-hour average ground-level concentrations of odour of five modelled years due to the pig farm**

Location:	**Averaging period:**	**Data source:**	**Units:**
Ballylanders, Co. Limerick	1-hour	CALPUFF	ou_E/m^3
Type:	**Criterion level:**	**Prepared by:**	**Date:**
98th percentile	5 ou (Red Line)	P McDowell	Jan 2023

APPENDIX A MODELLING METHODOLOGY

A1 METEOROLOGICAL MODELLING

A1.1 TAPM

The meteorological model, TAPM (The Air Pollution Model) Version 4.0.5, was developed by the CSIRO and has been validated by the CSIRO, Katestone and others for many locations in Australia, southeast Asia, North America and Ireland. Katestone has used the TAPM model throughout Australia and has performed well for simulating regional winds patterns. Katestone has recently used the TAPM model to generate gridded data over Cork city and Harbour. The data generated correlated well with observed data at Cork Airport. TAPM has proven to be a useful model for simulating meteorology in locations where monitoring data is unavailable.

TAPM requires synoptic meteorological information for the region surrounding the project. This information is generated by a global model similar to the large-scale models used to forecast the weather. The data are supplied on a grid resolution of approximately 75 km, and at elevations of 100 metres to five kilometres above the ground. TAPM uses this synoptic information, along with specific details of the location such as surrounding terrain, land-use, soil moisture content and soil type to simulate the meteorology of a region as well as at a specific location.

TAPM resolves local terrain and land-use features that may influence local meteorology and generates a meteorological dataset that is representative of Site-specific geographic conditions. A year of synoptic data must be selected as input for TAPM. The selection of this year should be such that the year is representative of typical meteorological conditions (and therefore is not necessarily the most recent year of available data) and whether monitoring data is available for the time period to validate the output dataset. In addition, Katestone's experience elsewhere suggests that variability of dispersion meteorological conditions from year to year are unlikely to change the outcome of the air quality assessment.

TAPM was configured as follows:

- 40 x 40 grid point domain with an outer grid resolution of 30 kilometres and nesting grids of 10, 3. 1 and 0.3 kilometres.
- 5 modelled years (1 January 2016 to 31 December 2020)
- Grid centered near the Project Site at latitude 52°23’30 and longitude -8°15’0
- US Geological Survey EROS global terrain height database
- TAPM default land use database, modified to be consistent with aerial imagery in the innermost grid
- 25 vertical grid levels
- No data assimilation.

A1.2 CALMET meteorological modelling

CALMET is an advanced non-steady-state diagnostic 3D meteorological model with micro-meteorological modules for overwater and overland boundary layers. The model is the meteorological pre-processor for the CALPUFF modelling system. CALMET is capable of reading hourly meteorological data as data assimilation from multiple Sites within the modelling domain; it can also be initialised with the gridded three-dimensional prognostic output from other meteorological models such as TAPM. This can improve dispersion model output, particularly over complex terrain as the near surface meteorological conditions are calculated for each grid point.

CALMET (version 6.5.0) was used to simulate meteorological conditions in the region. The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the 1 km grid. CALMET treats the prognostic model

output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

CALMET was configured with twelve vertical levels with heights at 20, 60, 100, 150, 200, 250, 350, 500, 800, 1600, 2600 and 4600 metres at each grid point.

All options and factors were selected in accordance with NSW EPA CALPUFF Guidance released by TRC Environmental in 2011 except where noted below.

Key features of CALMET used to generate the wind fields are as follows:

- Domain area of 151 x 151 grid cells at 200m spacing
- 5 years modelled (1 January 2016 to 31 December 2020)
- Prognostic wind fields input as MM5/3D.dat for “initial guess” field (as generated by TAPM)
- Gridded cloud cover from prognostic relative humidity at all levels
- No extrapolation of surface wind observations to upper layers (not used in no-obs mode)
- Terrain radius of influence set to 5 km
- Maximum search radius of 10 grid cells in averaging process
- Use prognostic relative humidity
- Land use data modified to be consistent with aerial imagery.

All other options set to default.

A2 CALPUFF DISPERSION MODELLING

CALPUFF simulates the dispersion of air pollutants to predict ground-level concentration and deposition rates across a network of receptors spaced at regular intervals, and at identified discrete locations. CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing parameterisations for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. CALPUFF employs the 3D meteorological fields generated from the CALMET model by simulating the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal. CALPUFF takes into account the geophysical features of the study area that affects dispersion of pollutants and ground-level concentrations of those pollutants in identified regions of interest. CALPUFF contains algorithms that can resolve near-source effects such as building downwash, transitional plume rise, partial plume penetration, sub-grid scale terrain interactions, as well as the long-range effects of removal, transformation, vertical wind shear, overwater transport and coastal interactions. Emission sources can be characterised as arbitrarily-varying point, area, volume and lines or any combination of those sources within the modelling domain.

Key features of CALPUFF used to simulate dispersion:

- Domain area of 20 x 20 grid cells at 200m spacing, which is a sub-set of the CALMET domain centred on the Site
- 5 years modelled (1 January 2016 to 31 December 2020)
- Gridded 3D hourly-varying meteorological conditions generated by CALMET
- Partial plume path adjustment for terrain modelled
- Dispersion coefficients calculated internally from sigma v and sigma w using micrometeorological variables.

All other options set to default.

Environmental Protection Agency
Johnstown Castle Estate
Co. Wexford
Y35 W821

17th November 2023

Re: Ballyfaskin Pig Farm', Ballyfauskeen, Ballylanders, Co Limerick NIS Addendum

To Whom is Concerns

Based on the conclusions of the attached Ammonia Impact Assessment there is no significant cumulative impact on Natura Sites due to ammonia emissions and nitrogen deposition from the P0915-02 Pig Farm Development at Ballyfauskeen, Ballylanders, Co Limerick.

Kind Regards,

Aisling Walsh (M.Sc MCIEEM)

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Ammonia Impact Assessment – Integrated Pig Farm at Ballylanders, Limerick

Prepared for:

Ballyfaskin Enterprises Ltd

March 2023

Final

Prepared by:

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Approved by:	 Simon Welchman 23/02/2023

Contents

Tables

Figures

Glossary

Term	Definition
g/s	gram per second
kg	kilogram
kg/m³	Kilogram per cubic meter
km	kilometre
km/hr	kilometre per hour
m	metre
m/s	metres per second
m^2	square metres
m^3	cubic metres
m^3/s	cubic metres per second
m³/hr	cubic metres per hour
mg	milligram
Z_0	roughness length
µg/m³	micrograms per cubic meter
Abbreviations	**Definition**
AG4	Air Guidance 4
BAT	Best available techniques
EPA	Environmental Protection Agency
EF	Emission factor
EU	European Union

EXECUTIVE SUMMARY

Ballyfaskin Enterprises commissioned Katestone to complete an ammonia impact assessment (AIA) for a pig farm located at Ballylanders, County Limerick (Site). Ballyfaskin Enterprises proposes to:

- Increase pig numbers with the addition of new housing units immediately at the Site.
- Reconfigure the exhausts of existing naturally ventilated sheds at the Site with mechanically ventilated chimney stacks to reduce the impact of emissions exhausted to the atmosphere.

The assessment is required to determine the potential impact of ammonia emissions from the proposed development at the pig farm on ecologically sensitive locations on nearby Natura 2000 sites. The assessment will be submitted as part of planning and licensing applications for the pig farm.

The AIA was conducted in accordance with the stepwise assessment procedure described in EPA's Ammonia and Nitrogen Assessment Guidance (EPA, 2021) for intensive agricultural installation (IAI) and recognised techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4).

The stepwise procedure is designed to evaluate IAIs based on risk of adverse impacts due to ammonia emissions. Low risk projects can be evaluated using simple screening procedures (Step 1, Step 2 or Step 3). If an IAI does not meet the evaluation criteria of Step 1, Step 2 or Step 3, a detailed dispersion modelling assessment as described in Step 4, Step5 or Step 6 may be required and presented to EPA to consider the application.

Once an assessment meets the requirements of the evaluation criteria for any of the steps, the applicant does not need to consider the requirements of subsequent steps and an application can be made for EPA's consideration. If an assessment does not meet the evaluation criteria of a step, the applicant must undertake assessment described in subsequent steps to determine if the application can be presented for EPA's consideration.

For the proposed development, the results of Step 1 of EPA's Ammonia and Nitrogen Assessment Guidance indicates background levels of ammonia and nitrogen deposition exceed the critical level for ammonia or the critical load for nitrogen deposition at some locations on nearby Natura 2000 sites. Accordingly, the applicant was required to skip Step 2 and Step 3 and complete a Step 4 assessment. The Step 4 assessment indicated the following:

- The results exceeded the Step 4 evaluation criteria indicating that a cumulative assessment (Step 5 Assessment) would be required for the following locations:
    - The Galtee Mountains SAC (Receptors 1 - 31)
    - The Moanour Mountain SAC (Receptors 38 - 46)
- The results of the assessment were below the Step 4 evaluation criteria at all modelled locations on the River Suir SAC (Receptors 32 - 37) indicating that no further assessment would be required on this SAC.

An assessment was undertaken in accordance with the requirements of Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance. The results of the Step 5 assessment indicated that the cumulative impact of the pig farm with other IAIs was well below the in-combination evaluation criteria defined in Step 5 at all modelled locations.

Final Report Findings

In summary, the results of the assessment under EPA's Ammonia and Nitrogen Assessment Guidance indicate that the proposed pig farm **complies** with the EPA evaluation criteria at all sensitive locations, namely:

- River Suir SAC
- The Galtee Mountains SAC
- The Moanour Mountains SAC.

1. INTRODUCTION

Katestone Environmental Pty Ltd (Katestone) was commissioned by Ballyfaskin Enterprises Limited (Ballyfaskin Enterprises) to complete an assessment of the impact of ammonia and nitrogen on Natura 2000 sites in the vicinity of a pig farm it operates at Ballylanders, County Limerick (Site).

Ballyfaskin Enterprises proposes to:

- Increase pig numbers with the addition of four (4) rows of new housing units immediately northeast of the existing housing units at the Site.
- Reconfigure the exhausts of naturally ventilated sheds at the Site with mechanically ventilated chimney stacks to reduce the potential impact of emissions of ammonia and nitrogen exhausted to the atmosphere.

The pig farm is operated under an Industrial Emissions License (IEL). EPA issued an Integrated Pollution Prevention and Control (IPPC) licence (Register number P0915-01) for the housing units on 10 June 2013 (EPA, 2013a). The IPPC licence was amended to an IEL, which was issued by EPA to Ballyfaskin Enterprises on 16 December 2013 (EPA, 2013b). The licence boundary of the Site will have to be adjusted to incorporate the proposed new housing units.

This ammonia and nitrogen impact assessment was undertaken using dispersion modelling techniques. The dispersion modelling has been completed in accordance with the requirements of EPA's Air Dispersion Modelling Guidance Note (AG4). The assessment has also been conducted in accordance with Licence Application guidance issued by EPA titled: Assessment of the impact of ammonia and nitrogen on Natura 2000 sites from intensive agricultural installations (EPA, 2002), which is referred to here as EPA's Ammonia and Nitrogen Assessment Guidance.

2. OVERVIEW OF THE PIG FARM

The pig farm is located approximately 2.2 km east of the village of Ballylanders, Co. Limerick. It is located in an area of complex terrain being close to the lowest point of the valley. The Site is surrounded by elevated terrain, predominantly the Galtee Mountains. There are three (3) Natura 2000 sites within 10 km of the pig farm. The proposed licence boundary of the Site and its environs are presented in Figure 1. All pig housing units will be located within the proposed licence boundary of the Site.

A Site plan illustrating the layout of the existing housing units and proposed housing units is presented in Figure 2.

The existing housing units have the following maximum animal holding capacity:

- 1,038 Sows
- 5,360 weaners
- 3,892 Fattener pigs (Growers and finishers).

The new housing units will have maximum animal holding capacity of 2,592 fattener pigs.

A number of the existing housing units at the Site are naturally ventilated. As part of the proposed development, emissions from all housing units will be captured and ventilated through elevated chimney stacks. This will significantly reduce the potential impact of emissions in the vicinity of the Site.

The following buildings identified in Figure 2 are currently naturally ventilated and will be upgraded with a mechanical ventilation system as part of the proposed development.

- Building 1
- Building 2
- Building 3
- Building 7.

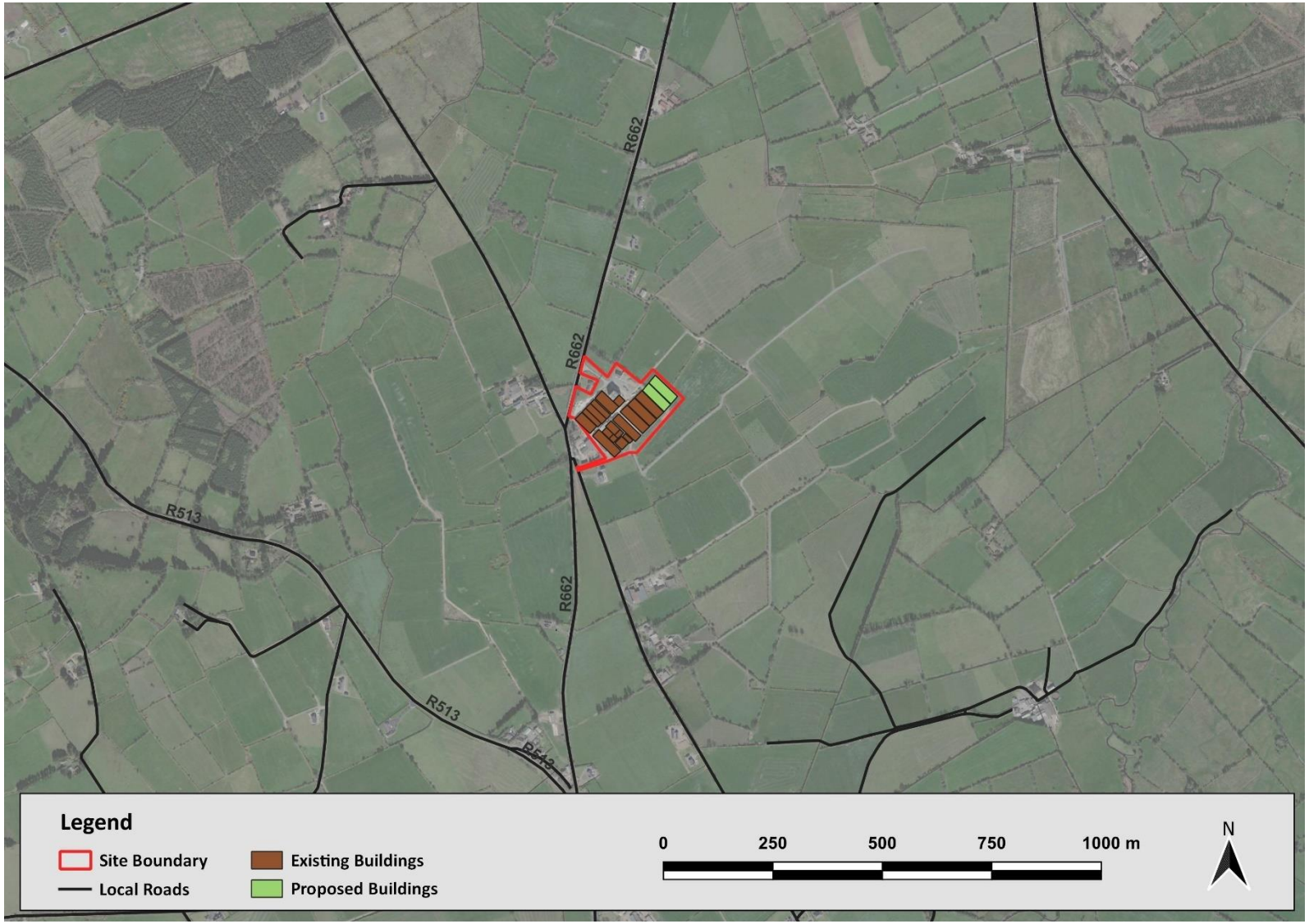

Figure 1 **Ballyfaskin pig farm proposed Site boundary (red line) and the surrounding environment**

Figure 2 **Ballyfaskin pig farm Site plan – existing and proposed housing units and existing and proposed chimney stacks**

3. REGULATORY FRAMEWORK AND ASSESSMENT CRITERIA

3.1 *Environmental Protection Agency Acts 1992 and 2003*

The *Environmental Protection Agency Act 1992 (EPA Act)* and Part 2 of the *Protection of the Environment Act 2003* are collectively referred to as the *Environmental Protection Agency Acts 1992 and 2003*. These Acts provide for the management of air emissions from activities (meaning any process, development or operation) that are listed in the First Schedule of the Acts.

Section 4 (2) of the *Environmental Protection Agency Acts 1992 and 2003* defines Air Pollution as follows:

> *"…the direct or indirect introduction to an environmental medium, as a result of human activity, of substances, heat or noise which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment, and includes –*
>
> *(a) 'air pollution' for the purposes of the Air Pollution Act 1987,*
>
> *(b) ……..*
>
> *(c) ……."*

The *Air Pollution Act 1987* (AP Act) provides for the control of air pollution and other matters connected with air pollution. Under the AP Act 'pollutant' means any substance that is specified in the First Schedule or any other substance (including a substance which gives rise to odour) or energy which, when emitted into the atmosphere either by itself or in combination with any other substance, may cause air pollution.

Section 4 of the AP Act defines air pollution as follows:

> *"Air pollution" in this Act means a condition of the atmosphere in which a pollutant is present in such a quantity as to be liable to —*
>
> (1) *be injurious to public health, or*
>
> *(ii) have a deleterious effect on flora or fauna or damage property, or*
>
> *(iii) impair or interfere with amenities or with the environment."*

Section 24 of the AP Act details the obligations of the occupier of a premises in respect to preventing emissions, nuisance and what constitutes defences against prosecution:

> *(1) The occupier of any premises, other than a private dwelling, shall use the best practicable means to limit and, if possible, to prevent an emission from such premises.*
>
> *(2) The occupier of any premises shall not cause or permit an emission from such premises in such a quantity, or in such a manner, as to be a nuisance.*
>
> *(3) In any prosecution for a contravention of this section, it shall be a good defence to establish that—*
>
> *(a) the best practicable means have been used to prevent or limit the emission concerned, or*
>
> *(b) the emission concerned was in accordance with a licence under this Act, or*
>
> *(c) the emission concerned was in accordance with an emission limit value, or*
>
> *(d) the emission concerned was in accordance with a special control area order in operation in relation to the area concerned, or*

I in the case of an emission of smoke, the emission concerned was in accordance with regulations under section 25, or

(f) the emission did not cause air pollution.

Section 75 (1) of the *Environmental Protection Agency Acts 1992 and 2003* requires the EPA to publish reasonable and desirable quality objectives to protect the environment, namely:

"The Agency shall, in relation to any environmental medium and without prejudice to its functions under section 103, specify and publish quality objectives which the Agency considers reasonable and desirable for the purposes of environmental protection."

3.2 Birds Directive and Habitats Directive

Concerned with the decline of wild bird species, EU Member States unanimously adopted the Birds Directive (79/409/EEC) in April 1979 that aims to conserve species of wild birds and the habitats that are crucial for their conservation. The Birds Directive was amended in 2009 (2009/147/EC).

The Habitats Directive (92/43/EEC) aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas.

The Habitats Directive requires EU Member States to take measures to maintain or restore natural habitats and wildlife species at a favourable conservation status. Sites designated under the Birds Directive and the Habitats Directive form the Natura 2000 network. Maintaining or restoring the Natura 2000 network is an obligation that must be considered concurrently with requirements for increased food production and economic growth targets set for agricultural sectors in EU Member States.

The main aim of the Habitats Directive is to contribute towards the conservation of biodiversity by requiring EU Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status. These annexes list habitats (Annex I) and species (Annexes II, IV and V) that are considered threatened in the EU territory. The listed habitats and species represent a considerable proportion of biodiversity in Ireland and the Habitats Directive itself is one of the most important pieces of legislation governing the conservation of biodiversity in Europe.

The protection and conservation duties of EU Member States for Natura 2000 sites are specified in Article 6 of the Habitats Directive and are summarised below:

- Article 6(1): establish necessary conservation measures, management plans and appropriate statutory, administrative or contractual measures which correspond to the ecological requirements of the natural habitats and species present at the sites
- Article 6(2): take appropriate steps to avoid deterioration of Natura 2000 sites
- Article 6(3) and 6(4): assess the impact of new plans and projects and only agree to the plan or project if it will not adversely affect the integrity of the site unless the plan or project is imperative for reasons of overriding public interest.

The European Communities (Birds and Natural Habitats) Regulations 2011 to 2015, as amended (Birds and Natural Habitats Regulations) give effect to the Habitats Directive in Irish law. The regulations require, inter alia, that a public authority carry out screening for Appropriate Assessment of a plan or project for which an application for consent is received, to assess, in view of best scientific knowledge and in view of the conservation objectives of the site, if that plan or project, individually or in combination with other plans or projects is likely to have a significant effect on the European site. Where it is determined that an Appropriate Assessment is required, the Birds and Natural Habitats Regulations require that the assessment carried out by a public authority include a determination

pursuant to Article 6(3) of the Habitats Directive as to whether or not the plan or project would adversely affect the integrity of a European site.

3.3 Ammonia impact assessment – Guidance

In May 2021, due to a high volume of intensive agriculture applications/reviews and licenses, the Environmental Protection Agency (EPA) published EPA's Ammonia and Nitrogen Assessment Guidance. It describes how applicants should assess, the impact of air emissions, as part of a licence application for the following activities listed under the First Schedule of the Environmental Protection Agency Acts 1992 as amended:

- Class 6.1 (the rearing of poultry in an installation, where the capacity exceeds 40,000 places)
- Class 6.2 (the rearing of pigs in an installation where the capacity exceeds – (a) 750 places for sows, or. (b) 2,000 places for production pigs).

EPA's Ammonia and Nitrogen Assessment Guidance describes a six-step process for the assessment of emissions of ammonia to the atmosphere from intensive agricultural installations (IAIs). Step 1 needs to be completed for all applications to inform the additional steps that need to be completed.

Compliance with the criteria defined in the subsequent steps means that no further steps need to be undertaken and the compliant results can be presented to EPA for review as part of the approvals process.

EPA's Ammonia and Nitrogen Assessment Guidance provides instructions on the steps needed to determine the information required to allow for an AA Stage 1 screening process and where necessary, a Stage 2 AA assessment for Natura 2000 sites (EPA, 2021). The six (6) steps are described in detail and in graphical summary format in EPA's Ammonia and Nitrogen Assessment Guidance.

The graphical summary format of the step-wise approach is reproduced here in Figure 3. Katestone followed the step-wise approach described in EPA's Ammonia and Nitrogen Assessment Guidance in this assessment. The methodology adopted to complete this assessment is described in Section 6.

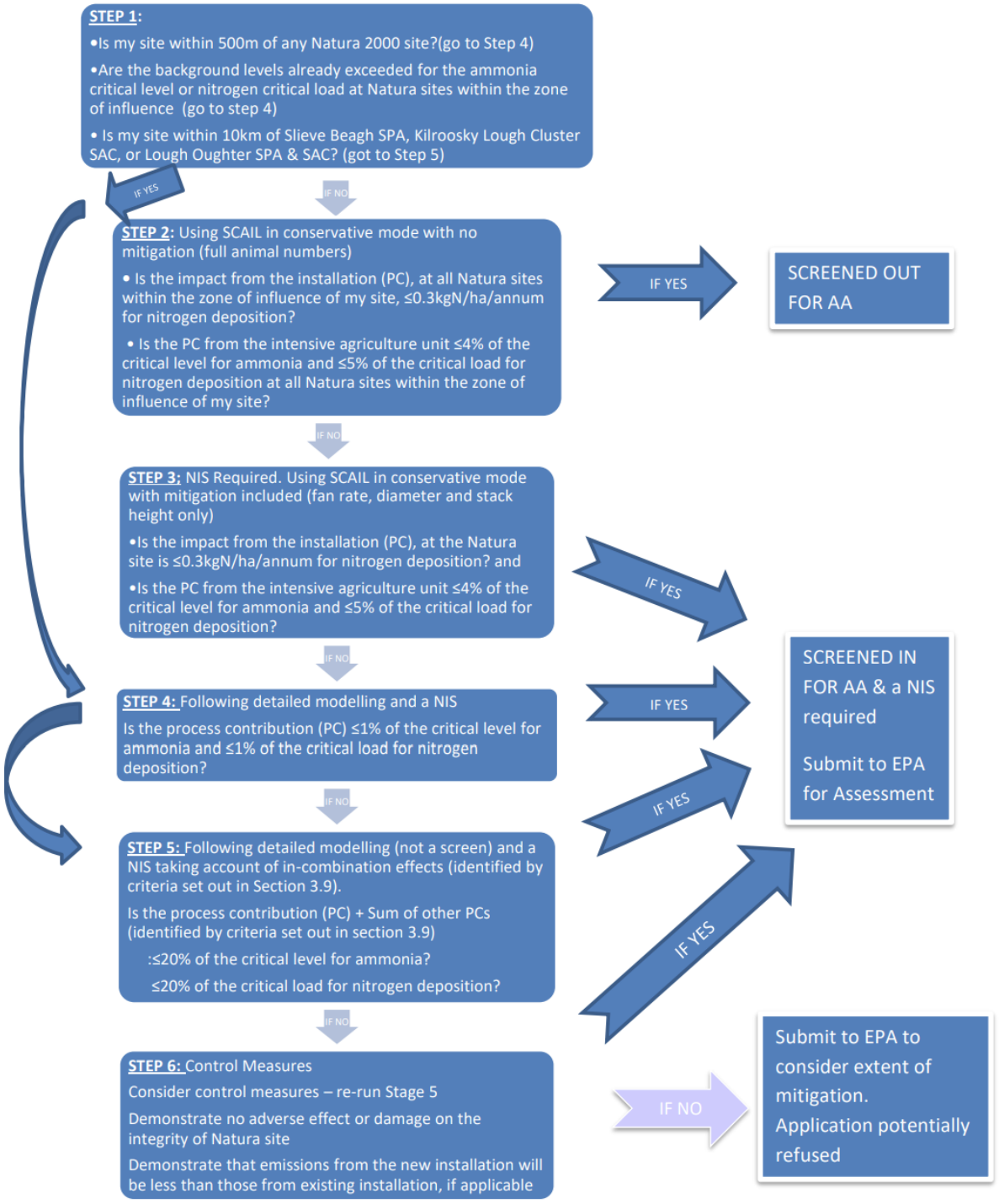

Figure 3 **The steps involved in the assessment process described in EPA's Ammonia and Nitrogen Assessment Guidance (reproduced from EPA, 2021)**

3.4 Assessment Criteria

The compliance criteria adopted in the assessment are based on critical limits. A critical limit, in its simplest form, is a threshold set to indicate when impacts on the terrestrial environment occur from air pollution. These can be used as part of the regulatory process for the assessment of impacts of air quality on terrestrial ecology (Kelleghan *et al.*, 2022). The EPA's Ammonia and Nitrogen Assessment Guidance adopts criteria based on critical limits including:

- Critical levels for ammonia
- Empirical critical loads for nitrogen deposition.

Both critical levels and loads are international guidelines used to protect habitats, primarily across Europe. Critical levels here, refer specifically to the threshold for impacts that can occur directly from atmospheric ammonia, allowing for an acute measurement of direct effects. Critical levels are defined as "the concentration in the atmosphere above which direct adverse effects on receptors, such as plants, ecosystems or materials, may occur according to present knowledge" (Posthumus, 1988; Kelleghan *et al.*, 2022).

Empirical critical loads are based on total nitrogen deposition. A critical load is defined as a deposition rate below which, significant harmful effects do not occur "according to present knowledge" (Posthumus, 1988).

The critical level for ammonia and the critical load for nitrogen deposition for each of the species and habitat are presented in Section 4.4 for the modelled discrete receptors.

4. EXISTING ENVIRONMENT

This section presents information on the existing environment in the vicinity of the Site, within the dispersion modelling domain and within the meteorological modelling domain. The meteorological modelling domain has been generated using geophysical data (terrain and land use) and meteorological data.

The extents of the dispersion modelling domain were determined based on the locations of the nearest ecological receptors in all directions from the Site.

4.1 Local terrain and land-use

The Site is in a remote rural location surrounded by pasture. There is a small amount of forestry located between the pig farm and the village of Ballylanders approximately 700 m west of the pig farm.

The pig farm is located in an area of complex terrain that will have significant effects on the meteorological patterns in the vicinity of the of the Site. The location of the Site in a valley and proximity to numerous hills and mountain ranges around the Site will result in unique weather patterns.

The pig farm is located in a valley at an elevation of approximately 170 m. The valley is bound by a number of mountains and hills including:

- The Galtee Mountains that rise to almost 800 m, 6 km east of the pig farm
- The Moanour Mountain that rises to approximately 370 m, 7.8 km northeast of the pig farm
- The Slievereagh Mountains that rise to 465 m, 6.7 km northwest of the pig farm
- Fear Breagach Mountains that rises to 362 m, 8.7 km northwest of the pig farm
- The Ballyhoura Mountains that rise to 528 m 13 km southwest of the pig farm
- Elevated land that runs west to east between the Ballyhoura Mountains and the Galtee Mountains south of the pig farm.

The terrain of the modelling domain is presented as:

- A 2-dimenstional surface plot in in Figure 4
- A 3-dimenstional surface plot in in Figure 5.

The mountains and hills of the modelling domain will affect synoptic scale wind patterns in the area by:

- Blocking wind coming from certain directions
- Channelling winds along the valleys created by the hills and mountains
- Creating very specific local air flows under low windspeed conditions due to katabatic and anabatic air flows created by the slopes of the complex terrain.

The predominant valley in which the pig farm is located is created by the Ballyhoura Mountains and Galtee Mountains, which result in a north-south oriented valley.

The proximity of the Site to local terrain and multiple water bodies is likely to have an important effect on dispersion conditions near the Site and across the modelling domain.

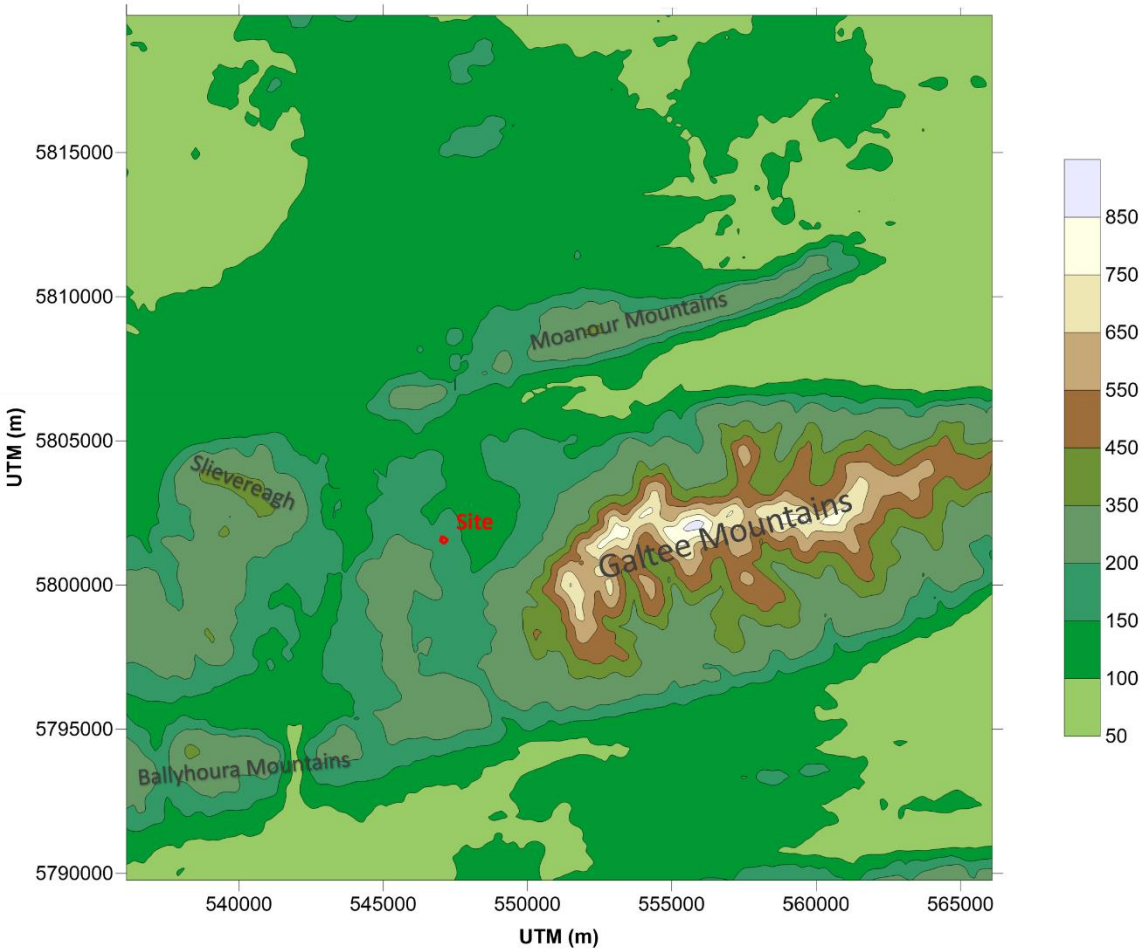

Figure 4 **2-dimensional terrain of the modelled domain**

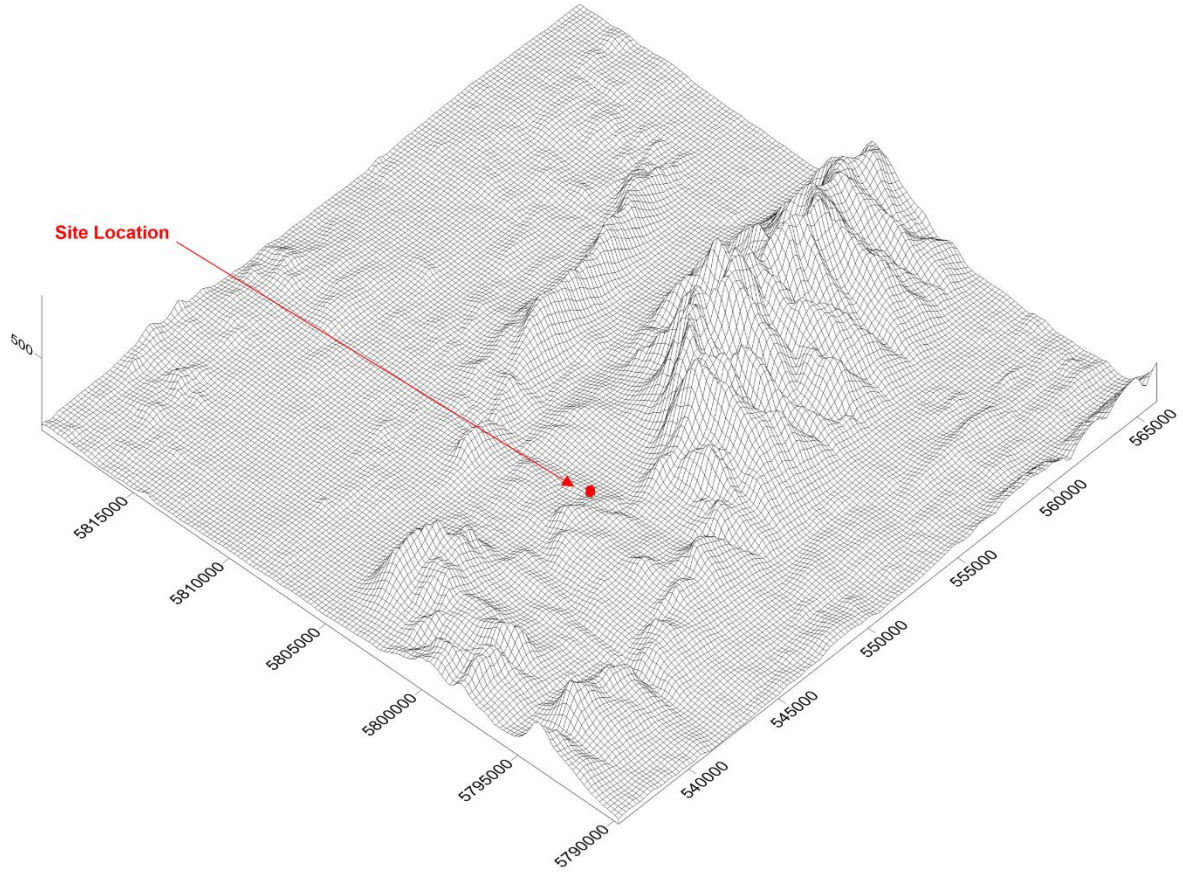

Figure 5 3-dimensional terrain of the modelled domain

4.2 Meteorology

Wind speed and wind direction are important parameters for the transport and dispersion of air pollutants from a source. The winds in the vicinity of the Site have been characterised using a three-dimensional meteorological model called CALMET. The 1-hour average wind speed for the modelling period is 4.33 m/s. This compares to a 1-hour average wind speed of 3.0 m/s at Moore Park between 2011 and 2018 and 4.3 m/s at Gurteen between 2008 and 2018 (EPA, 2020). A wind rose representing the annual distribution of 1-hour average winds is presented in Figure 6.

The prevailing wind direction in Ireland is between south and west. It is clear from Figure 6 that these winds influence wind patterns at the Site; however, due to the elevated terrain the modelling indicates that the south-westerly winds are channelled in a predominant southerly direction at the Site. Daytime winds between 6 am and 6 pm are heavily influenced by the prevailing winds and channelling due to local terrain. During late evening and early morning, prevailing winds also dominate; however, there is also a substantial proportion of winds from the northwest as indicated in the diurnal wind roses (Figure 7).

The seasonal distribution of wind speed and wind direction is presented in Figure 8. The strongest winds at the Site occur most frequently from the south during the winter months. The greatest proportion of light winds occur during summer. There is a distinct north-westerly component to the wind rose in all seasons. A significant proportion of light north-westerly winds occur during spring months.

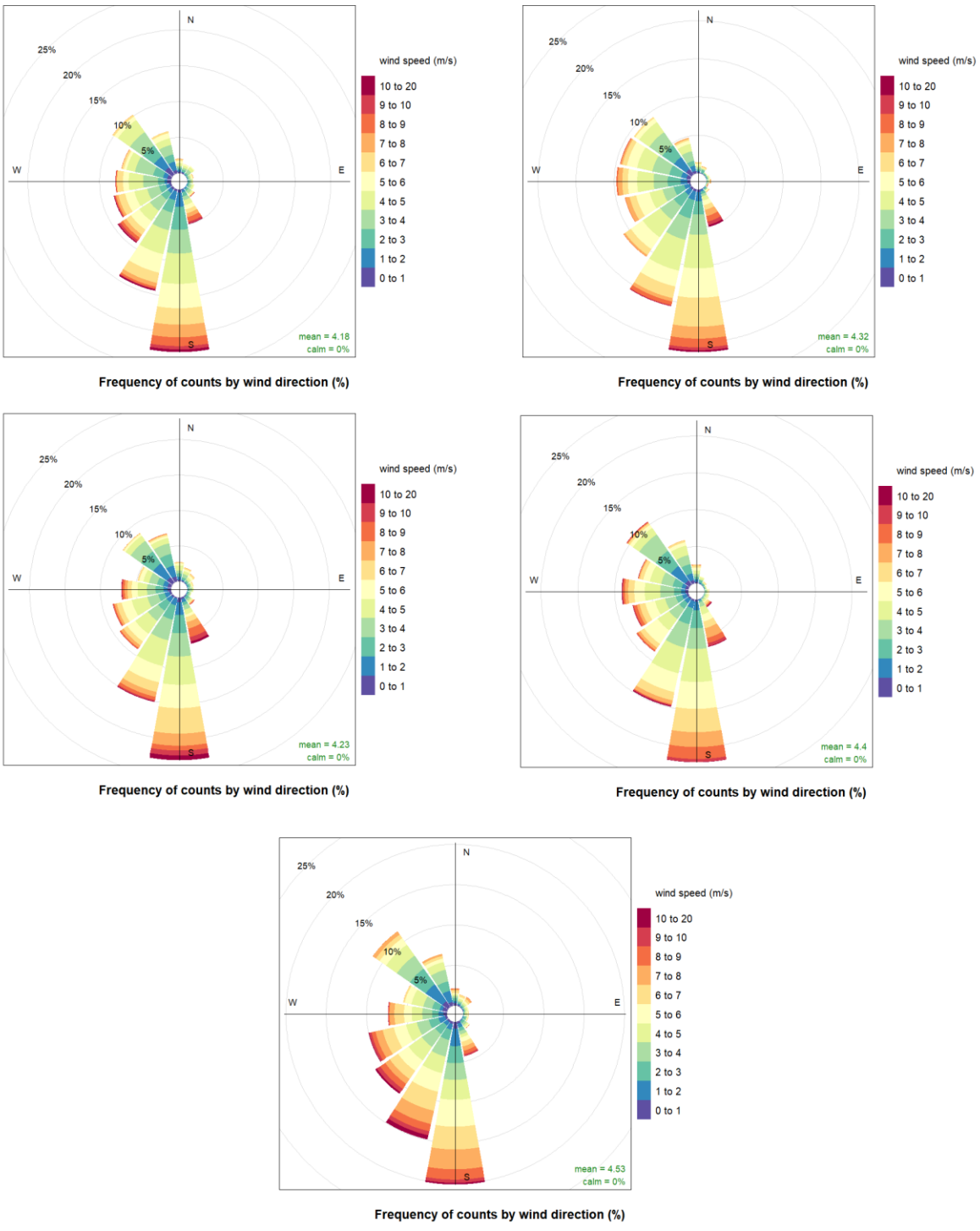

Figure 6 **Annual wind distribution predicted at the Site using CALMET for 2016 (top-left), 2017 (top-right), 2018 (mid-left), 2019 (mid-right) and 2020 (bottom)**

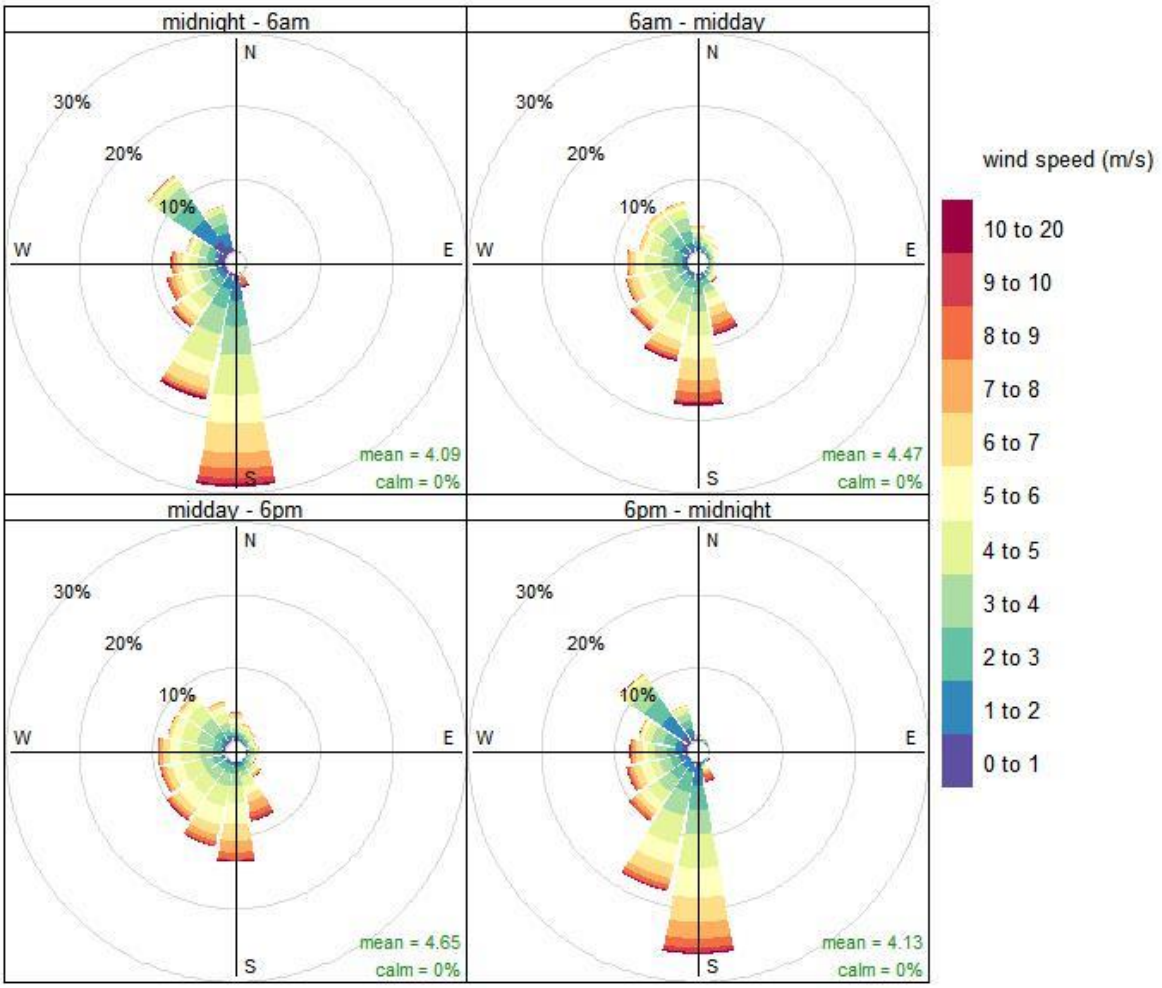

Figure 7 Diurnal wind distribution predicted at the Site using CALMET

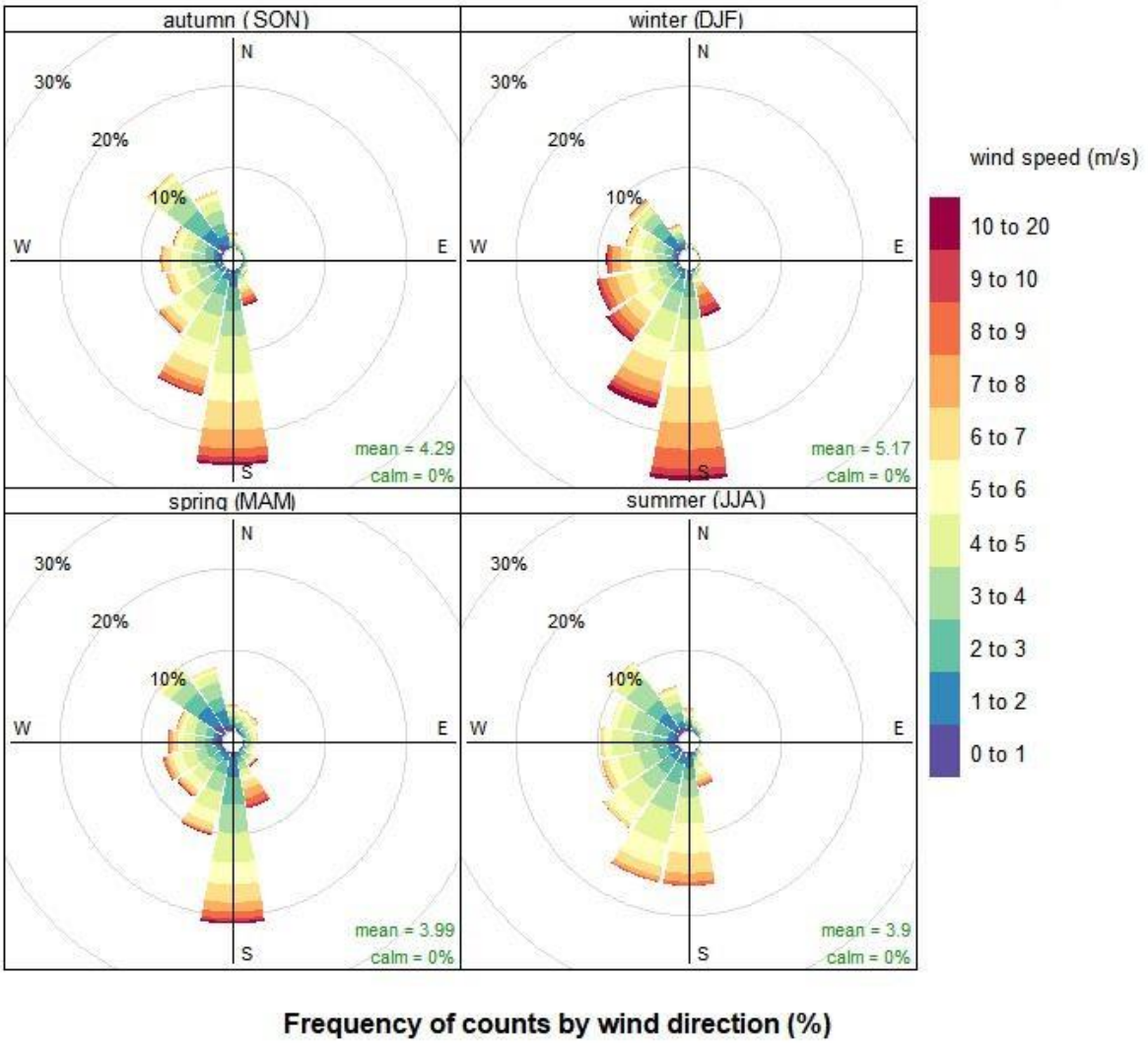

Figure 8 Seasonal wind distribution predicted at the Site using CALMET

4.3 Background concentrations of ammonia and nitrogen deposition

The background ammonia concentration and nitrogen deposition flux rates at each modelled sensitive receptor were obtained from the Simple Calculation of Atmospheric Impacts Limits (SCAIL) online tool as recommended in EPA's Ammonia and Nitrogen Assessment Guidance (EPA, 2021). The background concentrations of ammonia and nitrogen deposition levels adopted in the assessment are presented in Table 1.

Background ammonia concentration and nitrogen deposition flux rates adopted in the assessment were included in the assessment methodology defined in EPA's Ammonia and Nitrogen Assessment Guidance.

Table 1 The background concentrations of ammonia and nitrogen deposition levels adopted in the assessment (based on SCAIL)

Receptor	SCAIL Background	
	Concentration of ammonia (µg/m³)	Nitrogen Deposition Flux (kg/ha/yr)
DR1	1.87	8.78
DR2	1.75	8.7
DR3	1.75	8.7
DR4	1.75	8.7
DR5	1.67	8.64
DR6	1.74	8.02
DR7	1.74	8.02
DR8	1.74	8.02
DR9	1.74	8.02
DR10	1.74	8.02
DR11	1.98	7.84
DR12	1.98	7.84
DR13	1.98	7.84
DR14	1.68	8.73
DR15	1.98	7.84
DR16	1.98	7.84
DR17	2.28	7.56
DR18	1.9	7.97
DR19	1.9	7.97
DR20	2.22	7.51
DR21	1.9	7.97
DR22	2.22	7.51
DR23	1.7	8.8
DR24	1.91	7.78
DR25	2.28	7.58
DR26	1.8	8.06
DR27	2.1	7.51
DR28	2.54	7.63
DR29	2.1	7.62
DR30	2.1	7.61
DR31	2.37	7.6
DR32	2.37	7.59
DR33	2.63	7.51
DR34	2.63	7.51
DR35	2.63	7.51
DR36	2.48	7.09
DR37	2.61	7.26

Receptor	SCAIL Background	
	Concentration of ammonia (µg/m³)	Nitrogen Deposition Flux (kg/ha/yr)
DR38	2.52	7.42
DR39	2.52	7.42
DR40	2.52	7.42
DR41	2.31	7.42
DR42	2.31	7.42
DR43	2.31	7.42
DR44	2.31	7.42
DR45	2.31	7.42
DR46	2.31	7.42

4.4 Sensitive receptors

The sensitive receptors that are nearest to the Site are presented in Figure 9. The sensitive receptors included in the dispersion modelling assessment are at locations on Natura 2000 sites in the vicinity of the pig farm. EPA's Ammonia and Nitrogen Assessment Guidance required Natura 2000 sites within 10 km of an intensive agricultural installation to be included in a screening assessment. The Natura 2000 sites within 10 km of the pig farm that were considered in this assessment include:

- The Galtee Mountains SAC (00646)
- The Lower River Suir SAC (002137)
- The Moanour Mountains SAC (002257).

Approximately 40% of the Galtee Mountains SAC is within 10 km of the pig farm. A very small portion of the River Suir SAC is within 10 km of the pig farm. The entire Moanour Mountains SAC is within 10 km of the pig farm.

The Galtee Mountains SAC and the Moanour Mountains SAC that are within 10 km of the pig farm contain a range of ammonia and nitrogen sensitive species and habitats that are listed as conservation interests for these sites. The portion of the River Suir SAC within 10 km of the pig farm is a stretch of the Aherlow River (a tributary of the River Suir) that is less than 1 km in length. This stretch of the Aherlow River flows through agricultural land. A review of the conservation objectives published by NPWS for this portion of the River Suir SAC indicate that there are no ammonia and nitrogen sensitive species or habitats identified along the stretch of the Aherlow River within 10 km of the pig farm (NPWS, 2017).

The site-specific conservation objectives of a Natura 2000 site aim to define favourable conservation condition for particular habitats or species at that Natura 2000 site.

The habitats and species listed as conservation objectives at the Natura 2000 within 10 km of the pig farm and with sensitivity to atmospheric ammonia and nitrogen deposition include:

- Northern Atlantic wet heaths with Erica tetralix [4010] (Wet Heath)
- European dry heaths [4030] (European Dry Heath)
- Alpine and Boreal heaths [4060] (Alpine and Subalpine Heaths)
- Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] (Species-rich Nardus Grassland)
- Blanket bogs (* if active bog) [7130] (Blanket Bogs (If Active))

- Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8110] (Siliceous Scree)
- Calcareous rocky slopes with chasmophytic vegetation [8210] (Calcareous Rocky Slopes)
- Siliceous rocky slopes with chasmophytic vegetation [8220] (Siliceous Rocky Slopes).

These habitats are located as conservation objectives at the Natura 2000 sites as follows:

- The Galtee Mountains SAC (NPWS, 2017).
    - Wet heath
    - European dry heaths
    - Alpine and Subalpine Heaths
    - Blanket Bogs (* if active)
    - Siliceous Scree
    - Calcareous Rocky Slopes
    - Siliceous Rocky Slopes.
- The Moanour Mountains SAC (NPWS, 2019)
    - Wet heath
    - European dry heaths.

The Lower River Suir SAC includes areas of habitats and species with sensitivity to atmospheric ammonia and nitrogen deposition. However, none of the mapped areas of these habitats and species on the River Suir SAC are within 10 km of the pig farm (NPWS, 2017).

The critical level for ammonia and the critical load for nitrogen deposition for each of the species and habitat is presented in Table 2.

Table 2 The critical level for ammonia and the critical load for nitrogen deposition for each of the species and habitat within 10 km of the pig farm

Habitat or Species	Critical Level	Critical Load
	µg/m³	kg/ha/year
Wet heath	1.0	10
European dry heaths	1.0	10
Alpine and Subalpine Heaths	1.0	5
Blanket Bogs (* if active)	1.0	5
Siliceous Scree	1.0	5
Calcareous Rocky Slopes	1.0	5
Siliceous Rocky Slopes	1.0	5

The sensitive receptor locations included in the dispersion modelling assessment are presented graphically in a map in Figure 9. The sensitive receptors are presented in tabular format in Table 3, which includes for each location:

- The conservation objectives of the habitats or species identified at that point
- The critical level for ammonia adopted in the modelling assessment
- The critical load for nitrogen deposition adopted in the modelling assessment.

Table 3 **Sensitive receptor locations included in the dispersion modelling assessment, the conservation interest at each location, the critical level for ammonia adopted in the modelling assessment and the critical load for nitrogen deposition at each location**

Receptor	Species or Habitat							Relevant Criteria	
	Wet Heaths	Dry Heaths	Active blanket bogs	Alpine and Boreal Heaths	Siliceous Scree	Calcareous Rocky Slopes	Siliceous Rocky Slopes	Ammonia Concentration	Nitrogen Deposition
								µg/m³	kg/ha/yr
DR1	✓	ü			✓			1.0	5
DR2	✓				✓			1.0	5
DR3	✓				✓			1.0	5
DR4	✓				✓			1.0	5
DR5	✓		✓	✓	✓			1.0	5
DR6	✓		✓	✓				1.0	5
DR7	✓	✓	✓		✓			1.0	5
DR8	✓	✓	✓		✓			1.0	5
DR9	✓	✓						1.0	10
DR10	✓	✓	✓	✓				1.0	5
DR11	✓	✓	✓	✓				1.0	5
DR12	✓							1.0	10
DR13	✓	✓			✓	✓	✓	1.0	5
DR14			✓	✓	✓			1.0	5
DR15	✓	✓	✓					1.0	5
DR16	✓							1.0	10
DR17	✓	✓						1.0	10
DR18		✓						1.0	10
DR19	✓	✓	✓					1.0	5
DR20	✓	✓	✓	✓				1.0	5

Receptor	Species or Habitat							Relevant Criteria	
	Wet Heaths	Dry Heaths	Active blanket bogs	Alpine and Boreal Heaths	Siliceous Scree	Calcareous Rocky Slopes	Siliceous Rocky Slopes	Ammonia Concentration	Nitrogen Deposition
								µg/m³	kg/ha/yr
DR21	✓	✓		✓				1.0	5
DR22	✓	✓						1.0	10
DR23	✓	✓			✓	✓		1.0	5
DR24	✓	✓		✓				1.0	5
DR25	✓							1.0	10
DR26	✓				✓			1.0	5
DR27	✓				✓			1.0	5
DR28	✓							1.0	10
DR29	✓	✓						1.0	10
DR30		✓						1.0	10
DR31	✓	✓						1.0	10
DR32								3.0	30
DR33								3.0	30
DR34								3.0	30
DR35								3.0	30
DR36								3.0	30
DR37								3.0	30
DR38	✓	✓						1.0	10
DR39	✓	✓						1.0	10
DR40	✓	✓						1.0	10
DR41	✓	✓						1.0	10
DR42	✓	✓						1.0	10
DR43	✓	✓						1.0	10

Receptor	Species or Habitat							Relevant Criteria	
	Wet Heaths	Dry Heaths	Active blanket bogs	Alpine and Boreal Heaths	Siliceous Scree	Calcareous Rocky Slopes	Siliceous Rocky Slopes	Ammonia Concentration	Nitrogen Deposition
								µg/m³	kg/ha/yr
DR44	✓	✓						1.0	10
DR45	✓	✓						1.0	10
DR46	✓	✓						1.0	10

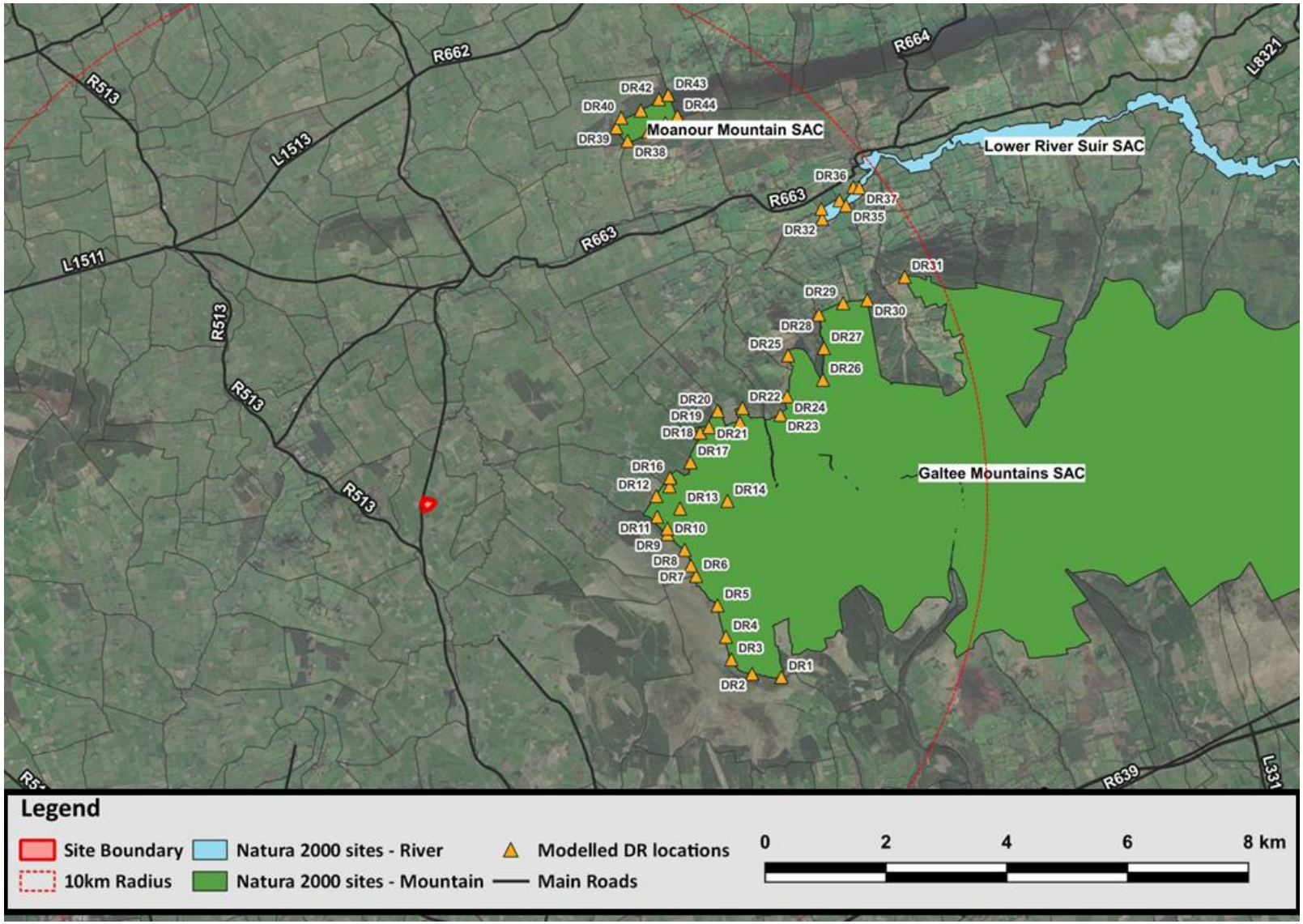

Figure 9 **The sensitive receptors included in the dispersion modelling assessment to represent locations on Natura 2000 sites**

5. ASSESSMENT

5.1 Dispersion modelling methodology

The following section describes the dispersion modelling methodology that was adopted to determine concentrations of ammonia and deposition rates of nitrogen from the pig farm in combination with background levels at ecologically sensitive locations near the Site. The methodology is based on a dispersion modelling study incorporating source characteristics and operational activity data of the pig farm with meteorological data that is representative of the Site and surrounding region. The dispersion modelling assessment has been prepared in accordance with industry standards, regulatory requirements and best practice approaches.

The assessment methodology has included:

- Determination of the locations and emission characteristics at the pig farm.
- Derivation of an emissions inventory based on its design and data from the literature for the pig farm.
- Generation of a representative meteorological dataset using prognostic meteorological modelling techniques.
- Characterisation of meteorological conditions in the region using prognostic meteorological data.
- Dispersion modelling using the regulatory dispersion model, CALPUFF, to predict ground-level concentrations of ammonia and nitrogen deposition:
    - At sensitive receptor locations
    - Across a cartesian grid that covers the modelling domain.

5.2 SCAIL-Agriculture

The baseline levels of ammonia and flux rates of nitrogen deposition at the sensitive ecological receptor locations were determined using SCAIL- Agriculture for Step 1 of EPA's Ammonia and Nitrogen Assessment Guidance.

SCAIL-Agriculture is a tool for assessing impacts of atmospheric nitrogen from agricultural installations in the UK and Ireland. It is a model underpinned by a detailed air dispersion model, AERMOD (Kelleghan *et al.*, 2022).

SCAIL-Agriculture includes estimates of baseline levels of ammonia and flux rates of nitrogen deposition across Ireland. The SCAIL-Agriculture ambient concentration model (1 x 1 km grid) has been updated to include modelled 2018 emissions by the UKCEH on behalf of the EPA. Similarly, the coarser international 2018 European Monitoring and Evaluation Programme (EMEP) national concentration and deposition models for Ireland have been made available through the AmmoniaN2K website (AmmoniaN2K, 2021). Both these models currently rely on the MapEire emissions model, which utilises cattle and sheep distribution from 2010 and locations of pig and poultry farms from 2015 according to the Irish Wildlife Manual 135 (Kelleghan *et al.*, 2022).

5.3 Meteorological modelling

5.3.1 Overview

EPA's Air Dispersion Modelling Guidance Note (AG4) states that the dispersion process is dependent on the underlying meteorological conditions and ensuring that the air dispersion model includes representative meteorological data is critical. In the absence of Site-specific meteorological data, AG4 requires the use of representative data observed at a Met Eireann monitoring location. AG4 states:

The USEPA (24) has defined meteorological representativeness as:

> *"the extent to which a set of {meteorological} measurements taken in a space-time domain reflects the actual conditions in the same or different space-time domain taken on a scale appropriate for a specific application"*

and has expanded on this definition by outlining the factors to consider in the selection of appropriate meteorological data:

- *Proximity of the meteorological station to the modelling domain;*
- *The complexity of the terrain;*
- *The exposure of the meteorological monitoring Site;*
- *The period of time during which data is collected."*

The modelling domain includes areas of complex terrain. The meteorological parameters that affect dispersion are likely to vary spatially and temporally across the modelling domain due to the complexity of the terrain.

The closest Met Eireann monitoring location to the Site is at Moore Park, Co. Cork, which is 22 km south of the pig farm. This monitoring station is in rural rolling landscape. It sits at a low point in the local terrain and is close to the Blackwater River. Meteorological data at Moore Park is characterised by frequent easterly and westerly winds that occur due to the east-west orientation of the valley in which the monitoring station is located. The meteorological station at Moore Park is not likely to be representative of meteorological conditions at the Site as the terrain at both locations is very different.

A review by Katestone indicates that there are no other meteorological observation stations on the Met Eireann Network that meet the requirements specified in AG4 to be considered representative of the modelling domain.

Where site-specific or representative meteorological data is not available, AG4 provides the following alternatives:

> *Prognostic meteorological data should be considered in locations where there is no comparable representative Met Eireann station particularly in areas of complex terrain or at a land / sea interface.*

and

> *Prognostic meteorological data may be useful in locations where there is no comparable representative Met Eireann station. Locations where prognostic meteorological data may be required include regions of complex terrain and at a land/sea interface in circumstances where the nearest meteorological stations are outside of the modelling domain. As outlined by the USEPA, meteorological data should be spatially representative of the modelling domain and in particular of the pathway from the source to the most impacted receptor.*

Accordingly, prognostic meteorological data was generated for the Site due to the complexity of the terrain. The approach adopted to generate representative site-specific data used a numerical model to generate a 3-dimensional grid of spatially varying meteorological parameters to represent conditions surrounding the Site. The approach is described in Appendix A1.

5.3.2 Meteorology

The prognostic model TAPM (developed in Australia by the Commonwealth Scientific and Industrial Research Organisation [CSIRO], version 4.0.5) and the diagnostic meteorological model CALMET (developed by EarthTec, version 6.5) were used to generate the three-dimensional meteorological dataset for the region.

The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the innermost nest. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial

guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

The three-dimensional wind field produced by TAPM/CALMET was then used to create a meteorological file suitable for us with the CALPUFF dispersion model.

Details of the model configuration and evaluation are presented in Appendix A.

The TAPM/CALMET approach has been used in jurisdictions like Australia to generate suitable meteorological data for modelling impacts for over 15 years. It has been adopted in the assessment of a number proposed projects in Ireland in the last 5 years. There is significant experience using these approaches in jurisdictions such as Australia. Industry specific guidance on modelling odour dispersion from sources such as intensive poultry farms and cattle feedlots recommend the use of TAPM/CALMET to generate representative site-specific data. Research in Europe indicates that meteorological data generated using a numerical model provided a better indication of locations where odour nuisance occurred (Feliubadaló et al, 2008). In that study, locations of likely odour nuisance were determined using the German VDI grid assessment approach. The correlation between observed and modelled odour concentrations was significantly better using the TAPM/CALMET approach compared to traditional steady state gaussian models such as AERMOD.

5.4 Emissions

The derivation of the ammonia emissions inventory adopted for the dispersion modelling assessment is presented in this section. Ammonia emission inventories were derived for the old housing units and the new housing units at the pig farm.

There are no emissions monitoring data available for the pig farm. Ammonia emission rates from the pig housing units at pig farms vary considerably depending on factors such as:

- The ventilation rate which is heavily influenced by:
    - The target temperature of the pigs in the unit which is influenced by:
        - Type of pig (sow, weaner, fattener).
        - The age of the pigs
    - The ambient temperature outside the pig unit.
- The design of the housing system including but not limited to the following:
    - Depth of manure holding pits
    - Frequency on manure removal
    - Ventilation design
    - Surface area of manure exposed beneath the slats.
- The depth of manure in the house, which varies considerably with season.

The ammonia emission inventory derived for the pig farm is based on:

- The design and operation of the old housing units and the new housing units at the pig farm.
- Ammonia emission rates for housing units presented in the latest Best Reference (BREF) document for the intensive rearing of poultry or pigs (IRPP) (EC, 2017).

The existing housing units are operated as traditional deep pit housing units. The pig diets at the existing housing units are formulated with reduced protein content to limit emissions. The pig diets at the existing housing units will continue to be formulated with reduced protein content to limit emissions.

The new housing units will be operated with reduced dietary crude protein feeds and with shallow tanks for slurry storage, which will require frequent removal to external slurry storage. These controls will ensure that the new housing units will operate in accordance with the requirements of BAT 30 in the BREF for IRPP.

The ammonia emission rates adopted in the dispersion modelling assessment are based on the emission rates of BAT compliant pig farms presented in the BREF for IRPP including the following based on data from Table 5.4 of the BAT conclusions, which presents the Bat Acceptable Emission limits (AELs) for piggeries that are designed and operated in accordance with BAT. The BAT-AELs for various BAT techniques are presented in the BAT conclusions as ranges. The upper limit of the ranges has been adopted for the old housing units for the proposed development as follows:

- 2.7 kg.animal^{-1}.year^{-1} for dry sows
- 2.7 kg.animal^{-1}.year^{-1} for gilts
- 5.6 kg.animal^{-1}.year^{-1} for farrowing sows
- 0.53 kg.animal^{-1}.year^{-1} for weaners
- 2.6 kg.animal^{-1}.year^{-1} for fatteners.

A single BAT-AEL is presented for fattener pigs in the BAT conclusions. Fattener pigs; however, can be classified as growers and finishers with growers defined as pigs in the weight range between 30 kg and 60 kg and finishers defined as pigs in the weight range between 60 kg and 120 kg. Fatteners are split into finishers and growers in Irish EPA guidance and modelling tools for the assessment of emissions from pig housing units including:

- The SCAIL online tool
- A draft EPA odour guidance document issued by EPA (EPA, 2022).

The rate of ammonia emissions from the SCAIL online tool for fatteners include:

- 4.14 kg.animal^{-1}.year^{-1} for finishers
- 1.59 kg.animal^{-1}.year^{-1} for growers.

SCAIL therefore indicates that emission rates of ammonia from growers are 38% of the emission rates of ammonia for finishers. In a pig production unit, one third of the fattener pigs are growers and two thirds are finishers. A weighted average emission rate for fatteners (finishers and growers) based on SCAIL ammonia emission rates and the proportion of pigs in each category is 3.29 kg.animal^{-1}.year^{-1}. This indicates that the ammonia emission rate for finishers is, on average, 79.4% of the ammonia emission rate of fatteners. The BAT-AEL for fatteners has been adapted for the number of grower and finisher pigs accommodated in the existing housing units and the new housing units by scaling the BAT-AEL for fatteners by 79.4% to account for the emission rate of growers and finishers as a combined group. The BAT-AEL for fattener pigs adopted in the assessment is, therefore, 2.1 kg.animal^{-1}.year^{-1}.

Ammonia emissions from the new housing units will be lower than the upper limit of the BAT-AEL range as the design and operation of the new housing units includes multiple BAT technologies.

The BREF document for the intensive rearing of poultry or pigs references a number of studies that quantified ammonia reduction efficiencies due to slurry cooling. These studies are described in a report of preparatory work for the use by the Technology Committee set up under the Danish Forest and Nature Agency in September 2007 in connection with discussions on the future requirements for documentation of environmental technology for agriculture. (Agrotech 2007)

The Danish and Dutch studies have shown that cooling is an effective method of reducing ammonia evaporation from manure channels and floors. As a starting point, it can be assumed that evaporation is reduced by–5 - 10 percent for each degree the temperature is lowered (Pedersen, 1997). In finisher barns with partially slatted floors and scrapers in the manure channels, the maximum reduction is estimated to be 40% measured in relation to a

reference barn with full slatted floor and 30% in relation to a barn with partially slatted floor (Pedersen, 2003). In gestation barns with loose housing and partially slatted floor, the maximum reduction is 30% compared to a similar barn without cooling.

Based on the information presented in the BREF document, this assessment has conservatively assumed that emissions of ammonia from the new housing units will be 20% less than the upper limit of the BAT-AEL range. This is conservative because multiple BAT compliant technologies are proposed to be used as detailed above.

The ammonia emission rates adopted for the new housing units for the proposed development are as follows:

- 2.2 kg.animal^{-1}.year^{-1} for dry sows
- 2.2 kg.animal^{-1}.year^{-1} for gilts
- 4.5 kg.animal^{-1}.year^{-1} for farrowing sows
- 0.4 kg.animal^{-1}.year^{-1} for weaners
- 1.7 kg.animal^{-1}.year^{-1} for fatteners.

5.5 Dispersion modelling

The assessment was conducted in accordance with recognized techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). CALPUFF was used to predict ground-level concentrations of ammonia and nitrogen deposition rates across the modelling domain and at sensitive ecological receptor locations on nearby Natura 2000 site due to sources at the pig farm.

The details of source characterization utilized for the pig farm in the modelling assessment are provided in Section 5.9.

5.6 Deposition

Deposition flux rates of nitrogen at sensitive receptors were estimated based on the predicted concentrations of ammonia across the modelled domain and using the following calculation methodology that is described in AG4:

> *The critical loads in ecologically sensitive areas such as SPAs, SACs and NHAs can be determined using the methodology outlined in the UK publication "AQTAG06 – Technical Guidance on Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air" (Environment Agency, 2014)(64) . The approach is based on using the maximum annual average ground level concentration within the ecologically sensitive area and converting this concentration into a deposition flux based on a chemical species specific deposition velocity (m/s) as outlined in Table A3.*

24ecommendmended dry deposition velocities for ammonia in Table A3 of AG4 are:

- 0.02 m/s for grassland
- 0.03 m/s for forest.

Dry deposition flux (µg m^{-2} s^{-1}) is calculated as the product of the ground-level process contribution (µg/m^3) and the deposition velocity (m/s).

The dry deposition velocities adopted in the modelling assessment was assumed to be 0.02 m/s for all modelled sensitive locations as the modelled locations do not contain forestry.

5.7 Building downwash

When modelling emissions from an industrial installation it should be borne in mind that stacks that are relatively short can be subjected to additional turbulence due to the presence of nearby buildings. Buildings are considered nearby if they are within five times the lesser of the building height or maximum projected building width (but not greater than 800m) (EPA, 2020).

A plume of a short stack is likely to be downwashed if its height is less than two and a half times the height of nearby buildings within a distance of 10 x L from each source, where L is the lesser of the height or width of the building. A Building Profile Input Program (BPIP) was used to determine the effects of buildings on the point sources of emissions at the pig farm. The Plume Rise Model Enhancements (PRIME) algorithm is recommended in EPA Guidance for use with AERMOD. PRIME was used in the dispersion modelling assessment to determine the effect of building induced turbulence on plumes from point sources at the pig farm.

The PRIME algorithm takes into account the position of each stack relative to each relevant building and the projected shape of each building for 36 wind directions (at 10º intervals). The model determines the change in plume centreline location with downwind distance based on the slope of the mean streamlines and coupled to a numerical plume rise model.

Twenty onsite buildings/structures have been included in the BPIP program to represent pig housing units and other onsite buildings. The coordinates used in the configuration of the pig housing units and onsite buildings in the PRIME BPIP model for this assessment are presented in Table 4.

Table 4 Pig housing units included and configuration of the pig housing units in BPIP

Building	Easting	Northing	Height (m)
	UTM (m)	UTM (m)	
B1	547184.3	5801543	5.2
	547133.6	5801592	
	547149.9	5801607	
	547199.7	5801558	
B2	547167.8	5801526	5.2
	547117	5801575	
	547132.9	5801590	
	547183.3	5801542	
B3	547151.5	5801509	5.2
	547100	5801559	
	547116.1	5801574	
	547167.4	5801525	
B4	547134.8	5801491	7.2
	547082.8	5801540	
	547096.5	5801554	
	547147.7	5801505	
B5	547087.3	5801505	4.5
	547066.7	5801526	
	547079.2	5801538	
	547100.1	5801518	
B6	547095.3	5801498	4.5

Building	Easting	Northing	Height (m)
	UTM (m)	UTM (m)	
	547087.2	5801505	
	547100	5801518	
	547107.8	5801511	
B7	547122.2	5801487	4.0
	547105.8	5801502	
	547112.3	5801509	
	547129.1	5801494	
B8	547104.3	5801472	4.0
	547088.3	5801488	
	547103.5	5801503	
	547119.6	5801488	
B9	547074.8	5801498	4.0
	547058.8	5801513	
	547069	5801523	
	547084.8	5801508	
B10	547085	5801488	4.0
	547074.8	5801498	
	547084.7	5801508	
	547095.1	5801498	
B11	547087	5801455	7.0
	547037.2	5801504	
	547051.6	5801518	
	547102.1	5801470	
B13	547031.3	5801509	6.0
	546997.3	5801542	
	547012.6	5801558	
	547046.6	5801526	
B14	547049.3	5801524	3.4
	547013.2	5801558	
	547021.4	5801567	
	547057.3	5801532	
B15	547058.5	5801531	4.0
	547021.4	5801567	
	547032.1	5801578	
	547069.2	5801543	
B16	547069.2	5801542	4.0
	547032.3	5801578	
	547041.1	5801587	
	547078.4	5801552	
B17	547080.9	5801554	7.0

Building	Easting	Northing	Height (m)
	UTM (m)	UTM (m)	
	547042.9	5801590	
	547058.6	5801607	
	547097.2	5801570	
B18	547097.9	5801570	18.3
	547084.5	5801583	
	547097.8	5801597	
	547111.4	5801584	
B19	547216.2	5801577	5.2
	547165.7	5801625	
	547180.4	5801642	
	547231.2	5801594	
B20	547200.6	5801559	5.2
	547150.9	5801608	
	547165.4	5801625	
	547215.4	5801576	

5.8 Sources of Emissions

The pig housing units included in the dispersion modelling assessment are presented in Table 5, which specifies:

- The housing unit at the pig farm (existing and proposed)
- The type of pigs housed (proposed development as modelled)
- The type of ventilation (proposed development as modelled)
- The number of pigs housed in the building (proposed development as modelled)
- The number of sources used to represent the mechanical ventilation points in the modelling assessment.

All pig housing units at the Site will be mechanically ventilated sheds and were configured as point sources in the modelling assessment.

The sources included in the modelling assessment, the number of pigs per source and the ammonia emission rate per source are presented in Table 6.

Table 5 Pig housing units included in the dispersion modelling assessment

Housing Unit	Type of Pig	Type of Ventilation	Number of Housed Pigs	Number of modelled sources
B1	Fattener	Mechanical	1296	2
B2	Fattener	Mechanical	1296	2
B3	Dry Sow	Mechanical	430	2
B4	Dry Sow	Mechanical	450	10
B5	Weaner	Mechanical	660	4
B6	Weaner	Mechanical	660	2
B7	Weaner	Mechanical	240	1
B8	Fattener	Mechanical	300	4
B9	Weaner	Mechanical	800	3
B10	Weaner	Mechanical	800	3
B11	Fattener	Mechanical	1000	14
B13	Weaner	Mechanical	2200	10
B14	Farrowing	Mechanical	46	8
B15	Farrowing	Mechanical	96	4
B16	Farrowing	Mechanical	96	4
B17	Dry Sow	Mechanical	350	4
B19a	Fattener	Mechanical	648	1
B19b	Fattener	Mechanical	648	1
B20	Fattener	Mechanical	1296	2

Table 6 Sources and ammonia emission rate of sources included in the modelling assessment

Housing unit	Source number	Number of pigs per source	Ammonia emission rate (ou/s)
B4	B4_1	45	0.0057
	B4_2	45	0.0057
	B4_3	45	0.0057
	B4_4	45	0.0057
	B4_5	45	0.0057
	B4_6	45	0.0057
	B4_7	45	0.0057
	B4_8	45	0.0057
	B4_9	45	0.0057
	B4_10	45	0.0057
B5	B5_1	165	0.0037
	B5_2	165	0.0037
	B5_3	165	0.0037
	B5_4	165	0.0037
B6	B6_1	330	0.0073
	B6_2	330	0.0073
B8	B8_1	75	0.0068

Housing unit	Source number	Number of pigs per source	Ammonia emission rate (ou/s)
	B8_2	75	0.0068
	B8_3	75	0.0068
	B8_4	75	0.0068
B9	B9_1	267	0.0059
	B9_2	267	0.0059
	B9_3	267	0.0059
B10	B10_1	267	0.0059
	B10_2	267	0.0059
	B10_3	267	0.0059
B11	B11_1	71	0.0065
	B11_2	71	0.0065
	B11_3	71	0.0065
	B11_4	71	0.0065
	B11_5	71	0.0065
	B11_6	71	0.0065
	B11_7	71	0.0065
	B11_8	71	0.0065
	B11_9	71	0.0065
	B11_10	71	0.0065
	B11_11	71	0.0065
	B11_12	71	0.0065
	B11_13	71	0.0065
	B11_14	71	0.0065
B13	B13_1	220	0.0049
	B13_2	220	0.0049
	B13_3	220	0.0049
	B13_4	220	0.0049
	B13_5	220	0.0049
	B13_6	220	0.0049
	B13_7	220	0.0049
	B13_8	220	0.0049
	B13_9	220	0.0049
	B13_10	220	0.0049
B14	B14_1	6	0.0014
	B14_2	6	0.0014
	B14_3	6	0.0014
	B14_4	6	0.0014
	B14_5	6	0.0014
	B14_6	6	0.0014
	B14_7	6	0.0014
	B14_8	6	0.0014

Housing unit	Source number	Number of pigs per source	Ammonia emission rate (ou/s)
B15	B15_1	24	0.0057
	B15_2	24	0.0057
	B15_3	24	0.0057
	B15_4	24	0.0057
B16	B16_1	24	0.0057
	B16_2	24	0.0057
	B16_3	24	0.0057
	B16_4	24	0.0057
B17	B17_1	88	0.0111
	B17_2	88	0.0111
	B17_3	88	0.0111
	B17_4	88	0.0111
B1	B1_T1	648	0.0588
	B1_T2	648	0.0588
B2	B2_T3	648	0.0588
	B2_T4	648	0.0588
B3	B3_T5	215	0.0273
	B3_T6	215	0.0273
B7	B7_1	240	0.0053
B19a	B19_T1	648	0.0340
B19b	B19_T2	648	0.0340
B20	B20_T1	648	0.0340
	B20_T2	648	0.0340

5.9 Source configuration

The pig housing units at the pig farm are all mechanically ventilated and were, therefore, modelled as point sources in the modelling assessment. This section describes the configuration of the point sources included in the CALPUFF modelling assessment.

Table 7 lists the point sources included in the modelling assessment and relevant modelling parameters including:

- The source coordinates
- The base elevations
- Stack height
- Stack diameter
- Exhaust temperature
- Exhaust velocity.

The building locations, configuration and heights were determined from Site plans provided by Ballyfaskin Enterprises, correspondence between Katestone and Ballyfaskin Enterprises and from satellite imagery.

Table 7 Source parameters for the point sources at the pig farm

Source Number	x-coordinate	y-coordinate	Base Elevation	Stack Height	Diameter	Temperature	Velocity
	km	km	m	m	m	°C	m/s
B4_1	547.140	5801.499	167.3	5.65	0.61	20	6.8
B4_2	547.138	5801.501	167.3	5.65	0.61	20	6.8
B4_3	547.136	5801.503	167.4	5.65	0.61	20	6.8
B4_4	547.134	5801.505	167.4	5.65	0.61	20	6.8
B4_5	547.130	5801.508	167.6	5.65	0.61	20	6.8
B4_6	547.128	5801.51	167.6	5.65	0.61	20	6.8
B4_7	547.126	5801.512	167.7	5.65	0.61	20	6.8
B4_8	547.124	5801.514	167.7	5.65	0.61	20	6.8
B4_9	547.119	5801.52	167.9	5.65	0.61	20	6.8
B4_10	547.112	5801.526	168.1	5.65	0.61	20	6.8
B5_1	547.080	5801.535	169.3	4.97	0.61	21	6.8
B5_2	547.086	5801.53	169.1	4.97	0.61	21	6.8
B5_3	547.092	5801.525	168.9	4.97	0.61	21	6.8
B5_4	547.097	5801.52	168.7	4.97	0.61	21	6.8
B6_1	547.102	5801.515	168.5	4.97	0.61	21	6.8
B6_2	547.107	5801.51	168.4	4.97	0.61	21	6.8
B8_1	547.105	5801.489	168.6	4.50	0.61	20	6.8
B8_2	547.104	5801.487	168.7	4.50	0.61	20	6.8
B8_3	547.106	5801.485	168.6	4.50	0.61	20	6.8
B8_4	547.107	5801.487	168.6	4.50	0.61	20	6.8
B9_1	547.066	5801.517	170.2	4.48	0.61	25	6.8
B9_2	547.070	5801.514	170.1	4.48	0.61	25	6.8
B9_3	547.075	5801.51	169.9	4.48	0.61	25	6.8
B10_1	547.080	5801.505	169.7	4.48	0.61	25	6.8
B10_2	547.084	5801.501	169.5	4.48	0.61	25	6.8
B10_3	547.089	5801.497	169.2	4.48	0.61	25	6.8
B11_1	547.088	5801.468	169.6	7.45	0.61	20	6.8
B11_2	547.090	5801.47	169.4	7.45	0.61	20	6.8
B11_3	547.086	5801.47	169.7	7.45	0.61	20	6.8
B11_4	547.088	5801.471	169.5	7.45	0.61	20	6.8
B11_5	547.071	5801.485	170.4	7.45	0.61	20	6.8
B11_6	547.069	5801.486	170.5	7.45	0.61	20	6.8
B11_7	547.071	5801.488	170.3	7.45	0.61	20	6.8
B11_8	547.073	5801.486	170.3	7.45	0.61	20	6.8
B11_9	547.058	5801.497	170.9	7.45	0.61	20	6.8
B11_10	547.059	5801.498	170.9	7.45	0.61	20	6.8
B11_11	547.054	5801.502	171.1	7.45	0.61	20	6.8
B11_12	547.055	5801.503	171.0	7.45	0.61	20	6.8

Source Number	x-coordinate	y-coordinate	Base Elevation	Stack Height	Diameter	Temperature	Velocity
	km	km	m	m	m	°C	m/s
B11_13	547.050	5801.505	171.2	7.45	0.61	20	6.8
B11_14	547.051	5801.506	171.2	7.45	0.61	20	6.8
B13_1	547.037	5801.518	171.7	5.55	0.61	21	6.8
B13_2	547.035	5801.52	171.7	5.55	0.61	21	6.8
B13_3	547.030	5801.524	171.9	5.55	0.61	21	6.8
B13_4	547.028	5801.527	171.9	5.55	0.61	21	6.8
B13_5	547.023	5801.532	172.0	5.55	0.61	21	6.8
B13_6	547.021	5801.534	172.1	5.55	0.61	21	6.8
B13_7	547.018	5801.536	172.2	5.55	0.61	21	6.8
B13_8	547.013	5801.541	172.3	5.55	0.61	21	6.8
B13_9	547.010	5801.544	172.3	5.55	0.61	21	6.8
B13_10	547.008	5801.546	172.4	5.55	0.61	21	6.8
B14_1	547.048	5801.526	171.0	3.92	0.45	22	5.6
B14_2	547.043	5801.531	171.1	3.92	0.45	22	5.6
B14_3	547.038	5801.535	171.3	3.92	0.45	22	5.6
B14_4	547.033	5801.54	171.4	3.92	0.45	22	5.6
B14_5	547.029	5801.544	171.5	3.92	0.45	22	5.6
B14_6	547.025	5801.548	171.6	3.92	0.45	22	5.6
B14_7	547.021	5801.552	171.7	3.92	0.45	22	5.6
B14_8	547.016	5801.557	171.7	3.92	0.45	22	5.6
B15_1	547.063	5801.544	170.0	4.55	0.61	22	6.8
B15_2	547.053	5801.553	170.3	4.55	0.61	22	6.8
B15_3	547.044	5801.562	170.5	4.55	0.61	22	6.8
B15_4	547.034	5801.571	170.7	4.55	0.61	22	6.8
B16_1	547.072	5801.554	169.5	4.55	0.61	22	6.8
B16_2	547.063	5801.563	169.7	4.55	0.61	22	6.8
B16_3	547.054	5801.572	169.9	4.55	0.61	22	6.8
B16_4	547.044	5801.581	170.2	4.55	0.61	22	6.8
B17_1	547.085	5801.566	168.8	7.45	0.61	20	6.8
B17_2	547.075	5801.575	169.1	7.45	0.61	20	6.8
B17_3	547.066	5801.584	169.3	7.45	0.61	20	6.8
B17_4	547.056	5801.592	169.6	7.45	0.61	20	6.8
B1_T1	547.196	5801.554	164.7	10.00	1.75	20	7.2
B1_T2	547.188	5801.546	165.1	10.00	1.75	20	7.2
B2_T3	547.180	5801.537	165.5	10.00	1.75	20	7.2
B2_T4	547.171	5801.529	165.9	10.00	1.75	20	7.2
B3_T5	547.163	5801.521	166.2	10.00	1.75	20	7.2
B3_T6	547.155	5801.512	166.6	10.00	1.75	20	7.2
B7_1	547.117	5801.498	168.1	6.00	1.75	21	7.2
B19_1	547.228	5801.588	163.5	10.00	1.75	20	7.2

Source Number	x-coordinate	y-coordinate	Base Elevation	Stack Height	Diameter	Temperature	Velocity
	km	km	m	m	m	°C	m/s
B19_2	547.220	5801.579	163.8	10.00	1.75	20	7.2
B20_1	547.211	5801.569	164.1	10.00	1.75	20	7.2

5.10 In-combination modelling assessment

An in-combination assessment is a requirement of Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance.

The in-combination modelling assessment needs to include other sources which may act in-combination with the application/review installation. The other sources that need to be included in the in-combination modelling assessment are defined in Section 3.9 of EPA's Ammonia and Nitrogen Assessment Guidance, which is reproduced here:

> *Other sources of nitrogen and ammonia (other PCs) to the Natura 2000 site(s), which could act in combination with emissions from the proposed/expanded installation, to impact the protected habitat, must be accounted for at relevant stages of the appropriate assessment process (screening stage details are set in Section 4 of this document). The in-combination assessment which needs to be conducted, is dependent on the size of the activity and the distance from the Natura site.*
>
> *At the target Natura 2000 site(s) (i.e. that/those identified, as possibly impacted by emissions from the applicant/review installation), all IAIs, which meet the following two criteria and which (with abatement in place), have a PC of ≥4% of the critical level for ammonia and/or ≥5% of the critical load for nitrogen deposition at the relevant Natura site must be included:*
>
> 1) *Developments that have planning permission and/or licences but are not yet (fully) operating; including those both above and below licensing thresholds that may contribute to ammonia and nitrogen emissions; and*
> 2) *Developments that started operating/increased their numbers, after the most recent update of background levels; including those both above and below licensing thresholds, that may contribute to ammonia and nitrogen emissions*
>
> *The criteria to use in order to determine the geographical range of the installations, which meet the above criteria, to include in the in-combination assessment is outlined below. (see Figure 1):*
>
> - *All below threshold installations within 5km of the Natura site*
> - *All licensed installations within 10km of the Natura site*

6. AMMONIA AND NITROGEN ASSESSMENT RESULTS

The results of the assessment are presented in this section. Katestone followed the step-wise approach described in EPA's Ammonia and Nitrogen Assessment Guidance in this assessment. The results of each step considered in the modelling assessment are presented in this section.

In summary, following the step-wise approach described in EPA's Ammonia and Nitrogen Assessment Guidance required the following steps to be completed:

- Step 1
- Step 4
- Step 5.

6.1 Results of Step 1

Question 2 of Step 1 in the EPA's Ammonia and Nitrogen Assessment Guidance asks:

> *Are the background levels already exceeded for the ammonia critical level or nitrogen critical load at Natura sites within the zone of influence of my site (as reported by SCAIL)?*

The background concentrations of ammonia and the background nitrogen deposition flux as determined using the SCAIL screening tool are presented along with the appropriate critical level for ammonia and critical load for nitrogen deposition fluxes in Table 8.

The results show that the background concentrations of ammonia and the background nitrogen deposition flux exceed the relevant critical level for ammonia and critical load for nitrogen deposition fluxes at a number of the modelled discrete receptor locations.

According to Step 1 of EPA's Ammonia and Nitrogen Assessment Guidance:

- The approaches using the SCAIL-Agriculture model described in Step 2 and Step 3 of the EPA's Ammonia and Nitrogen Assessment Guidance are not applicable.
- A detailed assessment completed in accordance with Step 4 of EPA's Ammonia and Nitrogen Assessment Guidance is, therefore, required to be completed. The results of the Step 4 assessment are presented in Section 6.2.

Table 8 Background concentrations of ammonia and the background nitrogen deposition flux as determined using the SCAIL screening tool are presented along with the appropriate critical level for ammonia and critical load for nitrogen deposition fluxes

Receptor	SCAIL background concentration of ammonia	Critical Level	SCAIL background nitrogen deposition flux	Critical Load
	µg/m³		kg/ha/yr	
DR1	**1.9**	1.0	**8.8**	5.0
DR2	**1.8**	1.0	**8.7**	5.0
DR3	**1.8**	1.0	**8.7**	5.0
DR4	**1.8**	1.0	**8.7**	5.0
DR5	**1.7**	1.0	**8.6**	5.0
DR6	**1.7**	1.0	**8.0**	5.0
DR7	**1.7**	1.0	**8.0**	5.0

Receptor	SCAIL background concentration of ammonia	Critical Level	SCAIL background nitrogen deposition flux	Critical Load
	µg/m³		kg/ha/yr	
DR8	**1.7**	1.0	**8.0**	5.0
DR9	**1.7**	1.0	8.0	10.0
DR10	**1.7**	1.0	**8.0**	5.0
DR11	**2.0**	1.0	**7.8**	5.0
DR12	**2.0**	1.0	7.8	10.0
DR13	**2.0**	1.0	**7.8**	5.0
DR14	**1.7**	1.0	**8.7**	5.0
DR15	**2.0**	1.0	**7.8**	5.0
DR16	**2.0**	1.0	7.8	10.0
DR17	**2.3**	1.0	7.6	10.0
DR18	**1.9**	1.0	8.0	10.0
DR19	**1.9**	1.0	**8.0**	5.0
DR20	**2.2**	1.0	**7.5**	5.0
DR21	**1.9**	1.0	**8.0**	5.0
DR22	**2.2**	1.0	7.5	10.0
DR23	**1.7**	1.0	**8.8**	5.0
DR24	**1.9**	1.0	**7.8**	5.0
DR25	**2.3**	1.0	7.6	10.0
DR26	**1.8**	1.0	**8.1**	5.0
DR27	**2.1**	1.0	**7.5**	5.0
DR28	**2.5**	1.0	7.6	10.0
DR29	**2.1**	1.0	7.6	10.0
DR30	**2.1**	1.0	7.6	10.0
DR31	**2.4**	1.0	7.6	10.0
DR32	2.4	3.0	7.6	30.0
DR33	2.6	3.0	7.5	30.0
DR34	2.6	3.0	7.5	30.0
DR35	2.6	3.0	7.5	30.0
DR36	2.5	3.0	7.1	30.0
DR37	2.6	3.0	7.3	30.0
DR38	**2.5**	1.0	7.4	10.0
DR39	**2.5**	1.0	7.4	10.0
DR40	**2.5**	1.0	7.4	10.0
DR41	**2.3**	1.0	7.4	10.0
DR42	**2.3**	1.0	7.4	10.0
DR43	**2.3**	1.0	7.4	10.0
DR44	**2.3**	1.0	7.4	10.0
DR45	**2.3**	1.0	7.4	10.0

Receptor	SCAIL background concentration of ammonia	Critical Level	SCAIL background nitrogen deposition flux	Critical Load
	µg/m³		kg/ha/yr	
DR46	**2.3**	1.0	7.4	10.0
Note: Bold text indicates where SCAIL background exceeds the critical level or critical load.				

6.2 Results of Step 4

Step 4 of EPA's Ammonia and Nitrogen Assessment Guidance requires a licensee/applicant to complete a detailed dispersion modelling assessment.

Dispersion modelling has been conducted for five years of meteorological data. The following sections present the highest concentrations across the five-year modelled period as Required by EPA dispersion modelling guidance.

The predicted ground-level concentrations of ammonia and annual average flux rate of nitrogen deposition at the nearest ecologically sensitive locations due to the pig farm are presented in Table 9.

The results in Table 9 are compared against the Step 4 criteria identified in EPA's Ammonia and Nitrogen Assessment Guidance, which require the process contribution of the pig farm (PC) to be:

- ≤1% of the critical level for ammonia
- ≤1% of the critical load for nitrogen deposition?

The results presented in Table 9 show that, in relation to the 1% threshold identified in Step 4 of EPA's Ammonia and Nitrogen Assessment Guidance, the PC due to the expanded pig farm:

- Exceeds for ammonia and nitrogen deposition at a number of modelled discrete receptor locations on:
    - The Galtee Mountains SAC (Receptors–1 - 31)
    - The Moanour Mountain SAC (Receptors–8 - 46).
- Does not exceed at any of the modelled discrete receptor locations on the River Suir SAC (Receptors – 2 - 37).

If the criteria identified in Step 4 of EPA's Ammonia and Nitrogen Assessment Guidance are exceeded, the licensee/applicant is required to undertake the assessment defined in Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance. Step 5 requires detailed modelling that takes account of in-combination effects. Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance is presented in Section 6.3 for the modelled sensitive locations on the Galtee Mountains SAC and the Moanour Mountains SAC.

Table 9 The predicted ground-level concentrations of ammonia and annual average flux rate of nitrogen deposition at the nearest ecologically sensitive locations due to the pig farm

Receptor	Concentration of ammonia (µg/m³)		PC as a percentage of Critical Level	Nitrogen Deposition Flux (kg/ha/yr)		PC as a percentage of Critical Load
	Process Contribution (Pig Farm)	Critical Level		Process Contribution (Pig Farm)	Critical Load	
DR1	0.0058	1.0	0.6%	0.036	5.0	0.7%
DR2	0.0064	1.0	0.6%	0.040	5.0	0.8%

Receptor	Concentration of ammonia (µg/m³)		PC as a percentage of Critical Level	Nitrogen Deposition Flux (kg/ha/yr)		PC as a percentage of Critical Load
	Process Contribution (Pig Farm)	Critical Level		Process Contribution (Pig Farm)	Critical Load	
DR3	0.0071	1.0	0.7%	0.045	5.0	0.9%
DR4	0.0076	1.0	0.8%	0.048	5.0	1.0%
DR5	0.0083	1.0	0.8%	0.052	5.0	1.0%
DR6	0.0104	1.0	1.0%	0.065	5.0	1.3%
DR7	0.0112	1.0	1.1%	0.070	5.0	1.4%
DR8	0.0120	1.0	1.2%	0.076	5.0	1.5%
DR9	0.0141	1.0	1.4%	0.089	10.0	0.9%
DR10	0.0143	1.0	1.4%	0.090	5.0	1.8%
DR11	0.0168	1.0	1.7%	0.105	5.0	2.1%
DR12	0.0180	1.0	1.8%	0.113	10.0	1.1%
DR13	0.0121	1.0	1.2%	0.076	5.0	1.5%
DR14	0.0079	1.0	0.8%	0.050	5.0	1.0%
DR15	0.0143	1.0	1.4%	0.090	5.0	1.8%
DR16	0.0146	1.0	1.5%	0.092	10.0	0.9%
DR17	0.0120	1.0	1.2%	0.076	10.0	0.8%
DR18	0.0135	1.0	1.3%	0.085	10.0	0.8%
DR19	0.0131	1.0	1.3%	0.083	5.0	1.7%
DR20	0.0141	1.0	1.4%	0.089	5.0	1.8%
DR21	0.0107	1.0	1.1%	0.067	5.0	1.3%
DR22	0.0116	1.0	1.2%	0.073	10.0	0.7%
DR23	0.0087	1.0	0.9%	0.055	5.0	1.1%
DR24	0.0090	1.0	0.9%	0.057	5.0	1.1%
DR25	0.0098	1.0	1.0%	0.062	10.0	0.6%
DR26	0.0077	1.0	0.8%	0.048	5.0	1.0%
DR27	0.0079	1.0	0.8%	0.050	5.0	1.0%
DR28	0.0097	1.0	1.0%	0.061	10.0	0.6%
DR29	0.0087	1.0	0.9%	0.055	10.0	0.6%
DR30	0.0075	1.0	0.8%	0.047	10.0	0.5%
DR31	0.0068	1.0	0.7%	0.043	10.0	0.4%
DR32	0.0141	3.0	0.5%	0.030	30.0	0.1%
DR33	0.0144	3.0	0.5%	0.030	30.0	0.1%
DR34	0.0141	3.0	0.5%	0.030	30.0	0.1%
DR35	0.0138	3.0	0.5%	0.029	30.0	0.1%
DR36	0.0143	3.0	0.5%	0.030	30.0	0.1%
DR37	0.0140	3.0	0.5%	0.029	30.0	0.1%
DR38	0.0194	1.0	1.9%	0.122	10.0	1.2%

Receptor	Concentration of ammonia (µg/m³)		PC as a percentage of Critical Level	Nitrogen Deposition Flux (kg/ha/yr)		PC as a percentage of Critical Load
	Process Contribution (Pig Farm)	Critical Level		Process Contribution (Pig Farm)	Critical Load	
DR39	0.0203	1.0	2.0%	0.128	10.0	1.3%
DR40	0.0196	1.0	2.0%	0.123	10.0	1.2%
DR41	0.0173	1.0	1.7%	0.109	10.0	1.1%
DR42	0.0155	1.0	1.5%	0.097	10.0	1.0%
DR43	0.0147	1.0	1.5%	0.093	10.0	0.9%
DR44	0.0147	1.0	1.5%	0.092	10.0	0.9%
DR45	0.0157	1.0	1.6%	0.098	10.0	1.0%
DR46	0.0172	1.0	1.7%	0.108	10.0	1.1%

6.3 Results of Step 5

Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance requires detailed modelling to determine the in-combination effects of:

- The pig farm
- Intensive agricultural installations (AIA) built or approved since the most recent update of background levels (determined using SCAIL-Agriculture)

The results of the in-combination assessment are assessed against the criteria identified in Step 5.

The most recent update to background levels of ammonia and nitrogen deposition was in 2018 with data used based on the locations of pig and poultry farms up to 2015 (Kelleghan *et al.*, 2022).

A review of nearby IAIs (IAI Review) was undertaken to identify all IAI developments that received licence/planning approval since 2015 or IAI developments that were built since 2015 within the following set-back distances identified in Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance:

- Licensed IAI within 10 km of the closest point of 1) The Galtee Mountains SAC and 2) the Moanour Mountains SAC to the pig farm.
- Sub-threshold Licensed IAI within 5 km of the closest point of 1) The Galtee Mountains SAC and 2) the Moanour Mountains SAC to the pig farm.

The IAI Review included detailed searches of satellite imagery, the EPA licence database and the planning systems of:

- Limerick County Council
- Tipperary County Council
- Cork County Council.

The areas searched were determined using the methodology defined in EPA's Ammonia and Nitrogen Assessment Guidance and are presented in Figure 10.

The IAI Review identified:

- There are a small number of IAI in the areas searched
- There have been no new EPA licence approvals for IAI within the search areas since 2015
- EPA has not approved any increases in stocking numbers at any EPA licensed IAI in the search areas after 2015
- EPA has not approved any licence amendments/reviews for any EPA licensed IAI in the search areas after 2015
- No planning approvals for sub-threshold IAI within a 5 km setback distance from the Galtee Mountains SAC have been issued after 2015
- A single IAI within the 5 km setback distance of the Moanour Mountains SAC has been built since 2015 and a planning application for further expansion of this facility was submitted in January 2023.

The results of the IAI Review identified:

- There is no requirement for a cumulative assessment of impacts on the Galtee Mountains SAC as no IAI meets the requirements of Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance to be included. Accordingly, the cumulative impact on the Galtee Mountains SAC of all IAI as defined in Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance is equal to the impact of the pig farm in isolation.

- The single IAI within the 5 km setback distance of the Moanour Mountains SAC that meets the requirements of Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance should be included in a cumulative assessment of the impacts on Moanour Mountains SAC.

The single IAI is a poultry facility used to house egg laying hens. It was included in the CALPUFF dispersion modelling assessment to determine its impacts on the Moanour Mountain SAC. A description of the poultry farm and its configuration in the modelling assessment is presented in Appendix B.

The results of the cumulative impact assessment described in this section was determined and presented against the Step 5 criteria for:

- The Galtee Mountains (Receptors–1 - 31) SAC in Section 6.3.1
- The Moanour Mountain SAC (receptors–8 - 46) in 6.3.2.

The results have been assessed against the Step 5 criteria identified in EPA's Ammonia and Nitrogen Assessment Guidance that require the cumulative impact to be less than:

- 20% of the critical level for ammonia
- 20% of the critical load for nitrogen deposition.

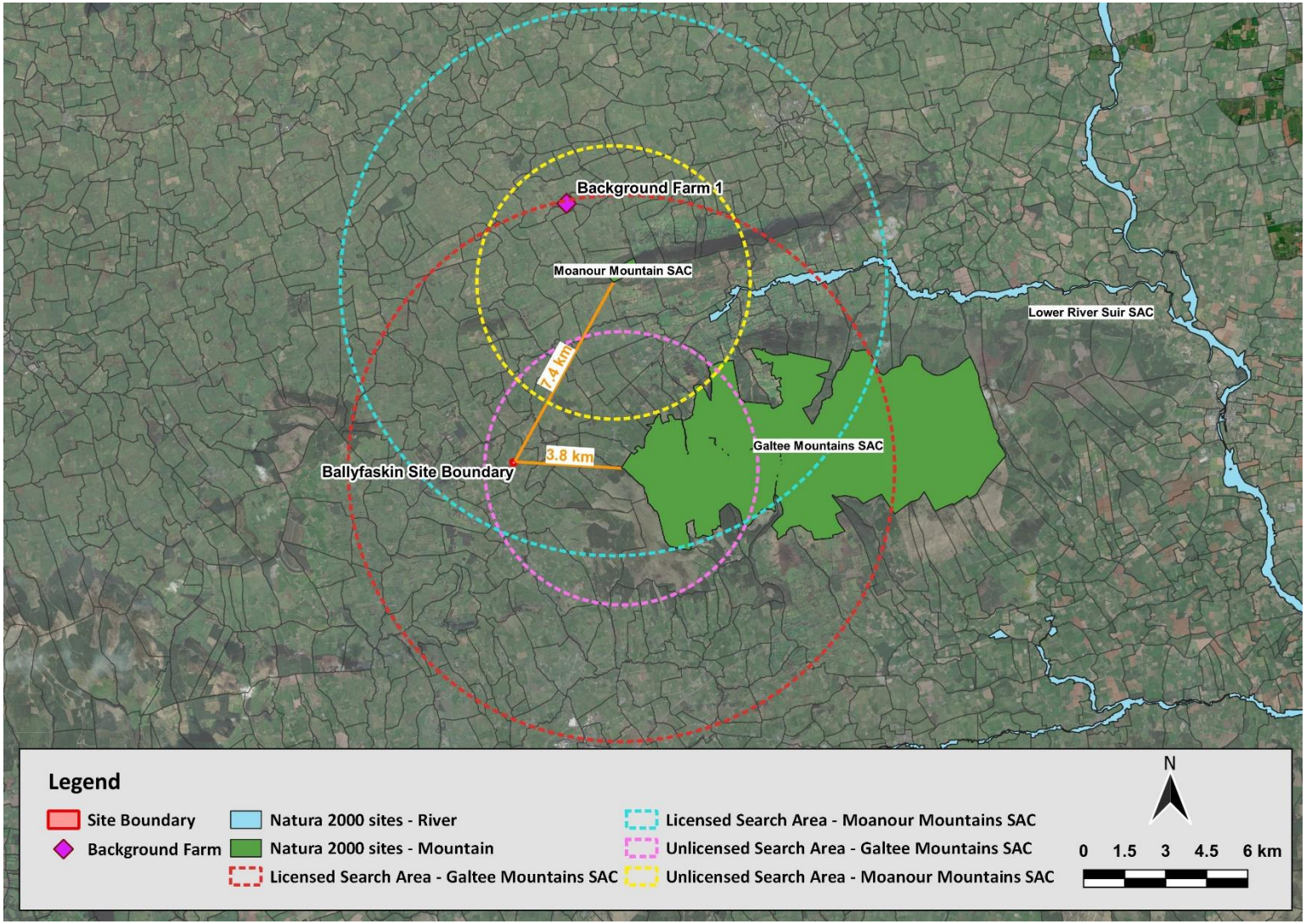

Figure 10 **Areas searched and background IAIs that were included in the cumulative assessment using the methodology defined in EPA's Ammonia and Nitrogen Assessment Guidance**

6.3.1 Step 5 Cumulative Assessment – Galtee Mountains SAC

The results of the Step 5 cumulative assessment on ecologically sensitive receptors on the Galtee Mountain SAC are presented in Table 10.

The results show that the worst-case cumulative impact due to the pig farm in combination with other IAIs that meet the requirements of Step 5 are:

- 1.8% of the critical level for ammonia
- 2.1% of the critical load for nitrogen deposition.

The predicted impacts are considerably lower than the 20% threshold level defined in Step 5 EPA's Ammonia and Nitrogen Assessment Guidance at all ecologically sensitive receptor locations modelled on the Galtee Mountain SAC.

Table 10 **The predicted cumulative ground-level concentrations of ammonia and annual average flux rate of nitrogen deposition at the ecologically sensitive locations on the Galtee Mountain SAC due to the pig farm in combination with background facilities that meet the requirements of Step 5**

Receptor	Concentration of ammonia (µg/m³)		PC as a percentage of Critical Level	Nitrogen Deposition Flux (kg/ha/yr)		PC as a percentage of Critical Load
	Process Contribution (Pig Farm)	Critical Level		Process Contribution (Pig Farm)	Critical Load	
DR1	0.0058	1.0	0.6%	0.036	5.0	0.7%
DR2	0.0064	1.0	0.6%	0.040	5.0	0.8%
DR3	0.0071	1.0	0.7%	0.045	5.0	0.9%
DR4	0.0076	1.0	0.8%	0.048	5.0	1.0%
DR5	0.0083	1.0	0.8%	0.052	5.0	1.0%
DR6	0.0104	1.0	1.0%	0.065	5.0	1.3%
DR7	0.0112	1.0	1.1%	0.070	5.0	1.4%
DR8	0.0120	1.0	1.2%	0.076	5.0	1.5%
DR9	0.0141	1.0	1.4%	0.089	10.0	0.9%
DR10	0.0143	1.0	1.4%	0.090	5.0	1.8%
DR11	0.0168	1.0	1.7%	0.105	5.0	2.1%
DR12	0.0180	1.0	1.8%	0.113	10.0	1.1%
DR13	0.0121	1.0	1.2%	0.076	5.0	1.5%
DR14	0.0079	1.0	0.8%	0.050	5.0	1.0%
DR15	0.0143	1.0	1.4%	0.090	5.0	1.8%
DR16	0.0146	1.0	1.5%	0.092	10.0	0.9%
DR17	0.0120	1.0	1.2%	0.076	10.0	0.8%
DR18	0.0135	1.0	1.3%	0.085	10.0	0.8%

Receptor	Concentration of ammonia (µg/m³)		PC as a percentage of Critical Level	Nitrogen Deposition Flux (kg/ha/yr)		PC as a percentage of Critical Load
	Process Contribution (Pig Farm)	Critical Level		Process Contribution (Pig Farm)	Critical Load	
DR19	0.0131	1.0	1.3%	0.083	5.0	1.7%
DR20	0.0141	1.0	1.4%	0.089	5.0	1.8%
DR21	0.0107	1.0	1.1%	0.067	5.0	1.3%
DR22	0.0116	1.0	1.2%	0.073	10.0	0.7%
DR23	0.0087	1.0	0.9%	0.055	5.0	1.1%
DR24	0.0090	1.0	0.9%	0.057	5.0	1.1%
DR25	0.0098	1.0	1.0%	0.062	10.0	0.6%
DR26	0.0077	1.0	0.8%	0.048	5.0	1.0%
DR27	0.0079	1.0	0.8%	0.050	5.0	1.0%
DR28	0.0097	1.0	1.0%	0.061	10.0	0.6%
DR29	0.0087	1.0	0.9%	0.055	10.0	0.6%
DR30	0.0075	1.0	0.8%	0.047	10.0	0.5%
DR31	0.0068	1.0	0.7%	0.043	10.0	0.4%
Cumulative assessment criteria			**20%**	**Cumulative assessment Criteria**		**20%**

6.3.2 Step 5 Cumulative Assessment – Moanour Mountains SAC

The results of the Step 5 cumulative assessment on ecologically sensitive receptors on the Moanour Mountain SAC are presented in Table 11.

The results show that the worst-case cumulative impact due to the pig farm in combination with other IAIs that meet the requirements of Step 5 are:

- 2.1% of the critical level for ammonia
- 3.3% of the critical load for nitrogen deposition.

The predicted impacts are considerably lower than the 20% threshold level defined in Step 5 EPA's Ammonia and Nitrogen Assessment Guidance at all ecologically sensitive receptor locations modelled on the Moanour Mountain SAC.

Table 11 **The predicted cumulative ground-level concentrations of ammonia and annual average flux rate of nitrogen deposition at the ecologically sensitive locations on the Galtee Mountain SAC due to the pig farm in combination with background facilities that meet the requirements of Step 5**

Receptor	Concentration of ammonia (µg/m³)				PC as a percentage of Critical Level	Nitrogen Deposition Flux (kg/ha/yr)				PC as a percentage of Critical Load
	Process Contribution (Pig Farm)	Background Farm	Cumulative	Critical Level		Process Contribution (Pig Farm)	Background Farm	Cumulative	Critical Load	
DR38	0.019	0.006	0.026	1.0	2.6%	0.12	0.04	0.16	10.0	1.6%
DR39	0.020	0.007	0.028	1.0	2.8%	0.13	0.05	0.17	10.0	1.7%
DR40	0.020	0.008	0.028	1.0	2.8%	0.12	0.05	0.17	10.0	1.7%
DR41	0.017	0.011	0.028	1.0	2.8%	0.11	0.07	0.18	10.0	1.8%
DR42	0.015	0.016	0.031	1.0	3.1%	0.10	0.10	0.20	10.0	2.0%
DR43	0.015	0.018	0.033	1.0	3.3%	0.09	0.11	0.21	10.0	2.1%
DR44	0.015	0.013	0.027	1.0	2.7%	0.09	0.08	0.17	10.0	1.7%
DR45	0.016	0.010	0.026	1.0	2.6%	0.10	0.07	0.16	10.0	1.6%
DR46	0.017	0.008	0.025	1.0	2.5%	0.11	0.05	0.16	10.0	1.6%
Cumulative assessment criteria					**20%**	**Cumulative assessment criteria**				**20%**

7. CONCLUSIONS

Ballyfaskin Enterprises commissioned Katestone to complete an ammonia impact assessment (AIA) for a pig farm located at Ballylanders, County Limerick, V35 KV12 (Site).

Ballyfaskin Enterprises proposes to:

- Increase pig numbers with the addition of four (4) rows of new housing units immediately northeast of the existing housing units at the Site.
- Reconfigure the exhausts of existing naturally ventilated sheds at the Site with mechanically ventilated chimney stacks to reduce the impact of emissions exhausted to the atmosphere.

The assessment is required to determine the potential impact of ammonia emissions from the proposed development at the pig farm on ecologically sensitive locations on nearby Natura 2000 sites. The assessment will be submitted as part of planning and licensing applications for the pig farm.

The AIA was conducted in accordance with:

- The stepwise procedure described in EPA's Ammonia and Nitrogen Assessment Guidance (EPA, 2021).
- Recognised techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). The dispersion model, CALPUFF, was used to predict ground-level concentrations of ammonia and nitrogen deposition flux rates across the model domain due to the pig farm.

The results of the AIA are presented here:

- The results of the Step 1 assessment indicated that:
    - The approaches using the SCAIL-Agriculture model described in Step 2 and Step 3 of the EPA's Ammonia and Nitrogen Assessment Guidance are not applicable
    - A detailed assessment completed in accordance with Step 4 of EPA's Ammonia and Nitrogen Assessment Guidance is, therefore, required to be completed.
- The results of the Step 4 assessment show that, in relation to the 1% threshold identified in Step 4 of EPA's Ammonia and Nitrogen Assessment Guidance, the PC due to the expanded pig farm:
    - Exceeds for ammonia and nitrogen deposition at a number of modelled discrete receptor locations on:
        - The Galtee Mountains SAC (Receptors–1 - 31)
        - The Moanour Mountain SAC (Receptors –8 - 46)
    - Does not exceed at any of the modelled discrete receptor locations on the River Suir SAC (Receptors –2 - 37).
- The results of the Step 4 assessment indicate that a Step 5 assessment, involving detailed modelling that takes account of in-combination effects, is required for the modelled sensitive locations on the Galtee Mountains SAC and the Moanour Mountains SAC.
- The Step 5 assessment requires a review of background IAIs that needed to be included in the in-combination assessment. This review determined:
    - There is no requirement for a cumulative assessment of impacts on the Galtee Mountains SAC as no IAI meets the requirements of Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance to be included. Accordingly, the cumulative impact on the Galtee Mountains SAC of all IAI as defined in Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance is equal to the impact of the pig farm in isolation.

    - The single IAI within the 5 km setback distance of the Moanour Mountains SAC that meets the requirements of Step 5 of EPA's Ammonia and Nitrogen Assessment Guidance should be included in a cumulative assessment of the impacts on Moanour Mountains SAC.

- The Step 5 assessment included an in-combination assessment of the pig farm and IAIs that met the requirement for inclusion in the modelling assessment. The results of the in-combination assessments show that:
    - At the Galtee Mountains SAC the worst-case cumulative impact due to the pig farm in combination with other IAIs that meet the requirements of Step 5 was well below in-combination assessment level of 20% with the highest modelled results at any of the modelled sensitive locations being:
        - 1.8% of the critical level for ammonia
        - 2.1% of the critical load for nitrogen deposition.
    - At the Moanour Mountains SAC the worst-case cumulative impact due to the pig farm in combination with other IAIs that meet the requirements of Step 5 was well below in-combination assessment level of 20% with the highest modelled results at any of the modelled sensitive locations being:
        - 2.1% of the critical level for ammonia
        - 3.3% of the critical load for nitrogen deposition.

The results of the assessment therefore indicate that:

- The impacts of the proposed pig farm in isolation are under EPA limits and therefore **complies** with the Step 4 evaluation criteria at all modelled locations on the River Suir SAC
- The cumulative impacts of the proposed pig farm with background IAIs are under EPA limits and therefore **complies** with the Step 5 evaluation criteria at all modelled locations on:
    - The Galtee Mountains SAC
    - The Moanour Mountains SAC.

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APPENDIX A MODELLING METHODOLOGY

A1 METEOROLOGICAL MODELLING

A1.1 TAPM

The meteorological model, TAPM (The Air Pollution Model) Version 4.0.5, was developed by the CSIRO and has been validated by the CSIRO, Katestone and others for many locations in Australia, southeast Asia, North America and Ireland. Katestone has used the TAPM model throughout Australia and has performed well for simulating regional winds patterns. Katestone has recently used the TAPM model to generate gridded data over Cork city and Harbour. The data generated correlated well with observed data at Cork Airport. TAPM has proven to be a useful model for simulating meteorology in locations where monitoring data is unavailable.

TAPM requires synoptic meteorological information for the region surrounding the project. This information is generated by a global model similar to the large-scale models used to forecast the weather. The data are supplied on a grid resolution of approximately 75 km, and at elevations of 100 metres to five kilometres above the ground. TAPM uses this synoptic information, along with specific details of the location such as surrounding terrain, land-use, soil moisture content and soil type to simulate the meteorology of a region as well as at a specific location.

TAPM resolves local terrain and land-use features that may influence local meteorology and generates a meteorological dataset that is representative of Site-specific geographic conditions. A year of synoptic data must be selected as input for TAPM. The selection of this year should be such that the year is representative of typical meteorological conditions (and therefore is not necessarily the most recent year of available data) and whether monitoring data is available for the time period to validate the output dataset. In addition, Katestone's experience elsewhere suggests that variability of dispersion meteorological conditions from year to year are unlikely to change the outcome of the air quality assessment.

TAPM was configured as follows:

- 40 x 40 grid point domain with an outer grid resolution of 30 kilometres and nesting grids of 10, 3. 1 and 0.3 kilometres.
- 5 modelled years (1 January 2016 to 31 December 2020)
- Grid centered near the Project Site at latitude 52°23’30 and longitude -8°15’0
- US Geological Survey EROS global terrain height database
- TAPM default land use database, modified to be consistent with aerial imagery in the innermost grid
- 25 vertical grid levels
- No data assimilation.

A1.2 CALMET meteorological modelling

CALMET is an advanced non-steady-state diagnostic 3D meteorological model with micro-meteorological modules for overwater and overland boundary layers. The model is the meteorological pre-processor for the CALPUFF modelling system. CALMET is capable of reading hourly meteorological data as data assimilation from multiple Sites within the modelling domain; it can also be initialised with the gridded three-dimensional prognostic output from other meteorological models such as TAPM. This can improve dispersion model output, particularly over complex terrain as the near surface meteorological conditions are calculated for each grid point.

CALMET (version 6.5.0) was used to simulate meteorological conditions in the region. The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the 1 km grid. CALMET treats the prognostic model

output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

CALMET was configured with twelve vertical levels with heights at 20, 60, 100, 150, 200, 250, 350, 500, 800, 1600, 2600 and 4600 metres at each grid point.

All options and factors were selected in accordance with NSW EPA CALPUFF Guidance released by TRC Environmental in 2011 except where noted below.

Key features of CALMET used to generate the wind fields are as follows:

- Domain area of 151 x 151 grid cells at 200m spacing
- 5 years modelled (1 January 2016 to 31 December 2020)
- Prognostic wind fields input as MM5/3D.dat for “initial guess” field (as generated by TAPM)
- Gridded cloud cover from prognostic relative humidity at all levels
- No extrapolation of surface wind observations to upper layers (not used in no-obs mode)
- Terrain radius of influence set to 5 km
- Maximum search radius of 10 grid cells in averaging process
- Use prognostic relative humidity
- Land use data modified to be consistent with aerial imagery.

All other options set to default.

A2 CALPUFF DISPERSION MODELLING

CALPUFF simulates the dispersion of air pollutants to predict ground-level concentration and deposition rates across a network of receptors spaced at regular intervals, and at identified discrete locations. CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing parameterisations for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. CALPUFF employs the 3D meteorological fields generated from the CALMET model by simulating the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal. CALPUFF takes into account the geophysical features of the study area that affects dispersion of pollutants and ground-level concentrations of those pollutants in identified regions of interest. CALPUFF contains algorithms that can resolve near-source effects such as building downwash, transitional plume rise, partial plume penetration, sub-grid scale terrain interactions, as well as the long-range effects of removal, transformation, vertical wind shear, overwater transport and coastal interactions. Emission sources can be characterised as arbitrarily-varying point, area, volume and lines or any combination of those sources within the modelling domain.

Key features of CALPUFF used to simulate dispersion:

- Domain area of 20 x 20 grid cells at 200m spacing, which is a sub-set of the CALMET domain centred on the Site
- 5 years modelled (1 January 2016 to 31 December 2020)
- Gridded 3D hourly-varying meteorological conditions generated by CALMET
- Partial plume path adjustment for terrain modelled
- Dispersion coefficients calculated internally from sigma v and sigma w using micrometeorological variables.

All other options set to default.

APPENDIX B – BACKGROUND FARM

A single sub-licence threshold IAI was identified that:

- Is within the 5 km setback distance for sub-licence threshold facilities of the Moanour Mountain SAC
- Was constructed since 2015, which is the year that current baseline levels identified in SCAIL-Agriculture are based on.

The IAI identified is a poultry facility (background farm) used to house egg laying hens. It was included in the CALPUFF dispersion modelling assessment to determine its impacts on the Moanour Mountain SAC. A description of the poultry farm and its configuration in the modelling assessment is presented here.

The background farm includes two housing units used to accommodate egg laying hens. A single housing unit was approved by Tipperary County Council in 2009 (Planning Reference 09696). This housing unit was built in 2020. A further planning application was made in 2022 (Planning Reference 22545) for a second housing unit at the site that would increase bird numbers at the site to 17,500 laying hens.

The modelling parameters and emission rates used to represent the two housing units in the CALPUFF assessment are presented in this section. The modelling parameters

The ammonia emission factor used to estimate emissions from these houses was 0.29 kg/bird place/year which is the emission factor for barn and free range laying hens published in the SCAIL-Agriculture model. This is the highest ammonia emission factor for any type of egg laying hen in the SCAIL-Agriculture model and is considered to provide a conservative basis for the determination of emissions from the background farm. There are 10 exhaust stacks on each poultry house and total ammonia emissions from the site were distributed evenly from each of these exhaust stacks resulting in an ammonia emission rate of 0.00804 g/s/stack.

Table B1 Modelling parameters adopted for the background farm in the CALPUFF modelling assessment

Source Number	x-coordinate	y-coordinate	Base Elevation	Stack Height[1]	Diameter[1]	Temp	Velocity
	km	km	m	m	m	°C	m/s
BG_1_1_1	549003	5811028	126.6	5.11	0.6	18	3.0
BG_1_1_2	549010	5811033	126.7	5.11	0.6	18	3.0
BG_1_1_3	549017	5811039	126.7	5.11	0.6	18	3.0
BG_1_1_4	549024	5811043	126.7	5.11	0.6	18	3.0
BG_1_1_5	549031	5811048	126.8	5.11	0.6	18	3.0
BG_1_1_6	549038	5811053	126.8	5.11	0.6	18	3.0
BG_1_1_7	549044	5811059	126.8	5.11	0.6	18	3.0
BG_1_1_8	549051	5811064	126.7	5.11	0.6	18	3.0
BG_1_1_9	549058	5811069	126.7	5.11	0.6	18	3.0
BG_1_1_10	549065	5811074	126.7	5.11	0.6	18	3.0
BG_1_2_1	549018	5811009	126.6	5.11	0.6	18	3.0
BG_1_2_2	549025	5811014	126.7	5.11	0.6	18	3.0
BG_1_2_3	549031	5811019	126.7	5.11	0.6	18	3.0
BG_1_2_4	549038	5811024	126.7	5.11	0.6	18	3.0
BG_1_2_5	549045	5811029	126.7	5.11	0.6	18	3.0
BG_1_2_6	549052	5811035	126.8	5.11	0.6	18	3.0
BG_1_2_7	549059	5811039	126.8	5.11	0.6	18	3.0
BG_1_2_8	549066	5811044	126.8	5.11	0.6	18	3.0
BG_1_2_9	549073	5811049	126.7	5.11	0.6	18	3.0
BG_1_2_10	549079	5811055	126.7	5.11	0.6	18	3.0

[1] The stack heights and diameters were taken from site drawings submitted with Tipperary Co. Co. planning application 22545
[2] A temperature of 18°C was used to represent the exhaust velocity for egg laying birds. This is the target temperature for the efficient production of eggs from egg laying birds
[3] There is limited data on the types of fans used to ventilate the poultry sheds in Tipperary Co. Co. planning application 22545. A conservative air flowrate of 3.0 m/s was adopted in the assessment which is highly conservative